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An Examination of the Relationship between Eating Competence and Biopsychosocial Factors in Adults with Metabolic Syndrome

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AN EXAMINATION OF THE RELATIONSHIP BETWEEN EATING COMPETENCE AND BIOPSYCHOSOCIAL FACTORS IN ADULTS WITH METABOLIC SYNDROME

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ABSTRACT

Background: An association between eating competence and bioclinical factors for healthy adults has been identified. However, no research has been conducted into the association of ecSI 2.0™ scores and biopsychosocial measures for adults with metabolic syndrome.

Purpose: To examine the congruence between eating competence and biopsychosocial measures at baseline and post-intervention in individuals with metabolic syndrome.

Methods: Self report surveys administered to participants: Satter Eating Competence Inventory (ecSI 2.0™), Short Form Health Survey Mental Health and Vitality scales(SF-36 MH and VT), Perceived Stress Scale (PSS), Patient Health Questionnaire – 8 (PHQ-8). Bioclinical measures: HDL cholesterol, triglycerides, blood glucose, BMI, and demographic data.

Results: ecSI 2.0™ scores were associated with lower stress, less depressive symptoms, greater mental health, and greater vitality. Findings did not support a relationship between eating competence and HDL-C, triglycerides, blood pressure, blood glucose, BMI, and waist circumference.

Conclusion: A relationship between some biopsychosocial factors and eating competence were identified, however further research with a larger sample size is suggested.

INTRODUCTION

Metabolic Syndrome

Definitions and Description

Metabolic Syndrome (MetS) is the occurrence of several symptoms that increase the risk of cardiovascular disease and diabetes mellitus.[1] These symptoms include, high blood pressure, high fasting blood glucose levels, and high triglyceride levels. Development of MetS is influenced by several genetic and environmental factors that contribute to the pathway of inflammation that leads to further development of disease.[1,2] Environmental factors include poor eating behaviors, a sedentary lifestyle, and food composition.[3,4] MetS prevalence is increasing exponentially, affecting approximately one-fifth of the United States population. Therefore, it is imperative that action be taken to reverse this trend.

Several definitions for MetS exist. The World Health Organization defines MetS as the presence of insulin resistance and the presence of two of the following risk factors: obesity, hyperlipidemia, hypertension, or microalbuminuria.[2] However, the National Cholesterol Education Program (NCEP) defines MetS as the presence of any three or more of the following: 1) blood glucose > 5.6 mmol/L (100 mg/dL) or drug treatment for elevated blood glucose, 2) high density lipoprotein cholesterol (HDL-C) < 1.0 mmol/L (40 mg/dL) in men, < 1.3 mmol/L (150 mg/dL) in women, or drug treatment for low HDL-C, 3) blood triglycerides > 1.7 mmol/L (150 mg/dL) or drug treatment for elevated triglycerides, 4) waist circumference > 102 cm for men, and > 88 cm for women, and 5) blood pressure > 130/85 mmHg or drug treatment for hypertension.[4] The International Diabetes Federation defines MetS very similarly to NCEP, but with more stringent waist circumference requirements of >94 cm in men and >80 cm in women and the presence of two or more of the other parameters outlined by NCEP.[4] Despite several

variations of the definition, MetS remains a predictor for further development of cardiovascular disease and diabetes mellitus.[2] Early diagnosis is crucial to improve the condition and MetS may be reversed. Treatment of MetS may be done through lifestyle and risk factor modifications, or through pharmacological methods, targeting individual components of MetS.

Treatments

Pharmacological interventions for MetS typically focus on correcting individual risk factors for MetS. Drugs that have proven effective target risk factors of obesity, high blood glucose levels, high triglycerides, low HDL-C, and high blood pressure. Anti-obesity drugs, such as orlistat and sibutramine, have been shown to reduce abdominal obesity.[5] Dyslipidemia is targeted through the prescription of statin drugs.[2] Insulin sensitizers, such as metformin, are utilized to target high blood glucose levels.[2,5] Despite pharmacological interventions decreasing the risk of MetS, their use leads to increased side effects that may be causing more long-term harm than good.[5] Side effects may include increased heart rate, fluid retention, gastrointestinal problems, and increased likelihood of urinary tract infections.[5]

Lifestyle modifications and programs have proven effective in reducing the risk factors of MetS.[7] Weight loss is a major component for the treatment of MetS, therefore lifestyle modifications that focus on weight management are ideal.[1,2] Significant improvements have been identified in individuals with MetS with as little as 5% to 10% bodyweight reduction.[1] This may be achieved through modifications in diet. These modifications include a reduction of caloric intake by 500-1000 calories per day or limiting the intake of saturated fats, cholesterol, and sodium.[2] These dietary modifications may also reduce other risk factors of MetS, including high

blood glucose levels, hypertension, low HDL-C, and high triglycerides.[1,2] Additionally, the introduction of moderate-intensity exercise and efforts to alter sedentary lifestyles are beneficial for MetS management.[2] Changes in eating behaviors have shown promise in the treatment of MetS, as well. Multifactor lifestyle modification programs promise in addressing several risk factors for MetS.[6]

Lifestyle Modification Programs

Research suggests lifestyle modifications, that include nutrition education and physical activity, are effective in the improvement of MetS factors.[6,7,8] This is supported by the observed association between decreased physical activity and poor nutrition with MetS criteria.[9] Nutrition is a key factor in the outcomes of MetS treatments, as well as improvements to cardiorespiratory fitness.[10] Cardiorespiratory fitness is positively associated with improvements in overall health, decreasing the likelihood of further development of MetS.[10] Improvements of cardiorespiratory fitness result in improvements of health, regardless of BMI, indicating fitness-based interventions may yield better benefits in the long run.[9,10] However, studies have also indicated that modest BMI and waist reduction greatly affect the prevalence of MetS and its components.[11,12] Similarly, lifestyle interventions have proven effective in the treatment of MetS in obese youth.[8,9] Therefore, multifactor interventions that include education, physical activity, and healthful eating show promising results in individuals with MetS and may be utilized for the remission and maintenance of remission in adults with MetS, and prevention of further diseased states such as cardiovascular disease.[6,12] One lifestyle approach to healthful eating is eating competence. Although competent eaters have a healthful bioclinical and psychological profile, little research has been done to see if this relationship is present in individuals with MetS.

Eating Competence

Definition and Description

The Satter Eating Competence Inventory (ecSI 2.0™) addresses eating attitudes and behaviors through the enjoyment of food and eating, paying attention to variety within the diet, tending to signals of hunger and satiety, and preparing meals and snacks regularly.[13] According to ecSI 2.0™, those who are competent eaters are comfortable with their eating and their enjoyment of eating. Four basic components comprise ecSI 2.0™: 1) eating attitudes and behavior (EA), 2) food acceptance skills (FA), 3) internal regulation of food intake (IR), and 4) contextual skills (CS). Individuals who are eating competent rely on internal hunger and appetite cues to inform food selection.[14]

Maintaining positive, confident, and comfortable attitudes about eating are crucial to support nutritional health. Positive attitudes are related to food acceptance and regulation. Eating attitudes as described in ecSI 2.0™ are:

- Positive interest in food and eating
- Responsive to inner and outer food experiences
- Relaxed about managing food and eating
- Harmony among food desires, food choices, and amounts eaten[14]

Food acceptance behaviors include positive interest in food, inclination to try new foods and learn to like them, and being comfortable when new foods are introduced. According to ecSI 2.0™, food acceptance behaviors include:

- Being calm in the presence of food, including new and disliked foods

- Being comfortable with eating preferred foods
- Being able to pick and choose from available foods
- Being able to settle for less-preferred food when necessary
- Inclination to experiment with new food
- Becoming familiar with new foods to enjoy and incorporate the new food into meals or snacks.[14]

Adults apply tendencies for food preference acquired in childhood to the current context. However, these behaviors and preferences are contingent on the economic and situational environment providing enough food to eat.[14]

Internal regulation of food intake means that hunger and satiety cues guide food regulation to support biologically preferred body weight.[14] Food regulation behaviors outlined in ecSI 2.0™ include:

- Ability to tolerate hunger to follow the social structure of meals
- Confidence enough food will be available at set eating times to properly satisfy hunger
- Ability to respond to internal regulators of hunger, appetite, and fullness
- Ability to stop eating when satisfied
- Comfort with the amount of food eaten and the experience of satiety
- Acceptance of body-weight that evolves from internally regulated eating.[14]

Internal regulatory cues continue to function properly, even when large portion sizes or caloric-dense foods are available, provided structured eating is maintained. Regulation of food intake will maintain stable body weight and optimum health for the individual. Additionally, regulation of food avoids any disruptions in energy supply that occur with typical weight-loss strategies.[14]

Structure and meal planning indicate individuals have intentionality with food. This means they intentionally feed themselves through providing preferred foods at set eating times. One of the primary goals within nutrition is to create structure, providing reliable access to foods. Eating context as described within ecSI 2.0™ includes:

- Having the resources to provide enough food at reliable times
- Being able to pay attention to food during eating
- Being able to delay eating and tolerate moderate hunger to maintain the structure of meals and snacks
- Being confident there will be enough food
- Choosing preferred foods to make food rewarding
- Being able to satisfy energy needs through the use of salt, fat, and sugar
- Making time for eating through time management
- Having an intrinsic reward system for choosing food to satisfy nutritional needs[14]

All components of the ecSI 2.0™ are interdependent; to maintain competency within eating context, one must have competencies within other areas as well. This is seen when frequent and reliable meals support positive attitudes about eating and trust in internal regulation cues of

hunger and satiety. Eating competence tenets can be incorporated into lifestyle education programs that target treatment of chronic diseases, such as MetS.[15]

Associations with Biomedical measures

A relationship between eating competence and biomedical measures has previously been established in healthy adults. Eating competence is established to be positively associated with improved health biomarkers in well-people.[16,17] In a study involving male and female individuals without chronic disease, those with higher measures of eating competence tended to have significantly lower blood pressure and lower ratios of total cholesterol to high-density lipoprotein cholesterol (HDL-C).[16] Additionally, eating competent persons were less likely to have elevated low-density lipoprotein cholesterol (LDL-C) and triglyceride levels.[16] Psota et al.[16] associate higher HDL-C and lower triglyceride values in healthy individuals with increased eating competence. Additionally, eating competent individuals had significantly lower blood pressure readings when compared to non-eating competent individuals.[16,18] In a study of male and female college students aged 18 to 24 years of age, lower eating competence was associated with higher BMI.[19] Eating competence was associated with a lower prevalence of abdominal obesity and better insulin sensitivity in Finnish adults with an increased risk of developing Type II Diabetes.[20] BMI was significantly lower in those who scored higher on ecSI and may be a mediator in the relationship between eating competence and Type 2 Diabetes.[18,20] The relationship between eating competence and biomedical markers has not been well investigated in individuals with MetS, however, the association between eating competence and biomarkers that comprise MetS has been established. This includes hypertriglyceridemia, low HDL-C, and increased insulin resistance being more prevalent in individuals with lower eating competence.[20]

More research into the association between eating competence and bioclincial markers in individuals with MetS is imperative.

Associations with Food Security

Eating competence levels in adults have been found to be influenced by the individual's socioeconomic status and food insecurity level.[21,22] Eating competence has been found to be lower in food insecure healthy individuals in a general sample of healthy individuals.[21] Additionally, the indication of "worrying about having money for food" in healthy individuals was negatively associated with eating competence.[23] The connection between food insecurity and eating competence is thought to be due to food choices being based primarily on familiarity and price, instead of health considerations or nutrition knowledge.[24] The relationship may also be explained by insufficient food availability appearing as food restriction or dietary restraint.[24]

Associations with Gender

Most of the literature that explores the relationship between gender and ecSI 2.0™ is in adults without chronic disease. Although not all studies show a relationship with gender,[18] many do. For example, Clifford et al.[25] found female college students were less likely to be eating competent than their male counterparts. These findings were consistent with findings from Brown et al.[17], who found male ecSI scores to be significantly higher than that of females. The connection between gender and eating competence may be explained by males having a more comfortable approach to eating.[22] Additionally, the prevalence of MetS is higher in women than men.[26] Women are also more likely to have MetS factors of increased waist circumference, low

HDL-C, and high blood glucose levels, but men are more likely to experience hypertension and high triglycerides.[26] Therefore, gender differences may influence the relationships between bioclinical factors and eating competence in a sample with MetS.

Association with Education

Higher education level is related to higher income and socioeconomic status.[27] Education and income level are highly associated, so education level may serve as an indicator of socioeconomic status. Higher socioeconomic status is associated with better diet quality.[27] Eating competence, as measured by the ecSI 2.0™, is affected by income restrictions.[22] Additionally, in previous studies, a sample of Brazilian females with lower education had higher overweight and obesity levels, which has also been associated with lack of eating competence.[19,28] Higher education levels have been associated with decreased cardiovascular risk[29] and MetS prevalence has been inversely associated with education level.[30] Thus, education may influence the relationship between ecSI 2.0™ and other biopsychosocial factors in a sample with MetS.

Association with Race

Dietary behaviors of minority groups are less healthful than non-minority groups.[31] Additionally, metabolic syndrome is more prevalent among minorities.[32] Thus, although no association of race with eating competence in a general sample has been identified to date[33], the possibility exists that eating competence may be influenced by race in a sample of persons with MetS.

Associations with Short Form-36 (SF-36)

The use of SF-36 as a measure of health-related quality of life is widely used within research in individuals with MetS. However, very few studies have examined the mental health or vitality component in individuals with MetS.[34] However, analysis of a longitudinal study has identified the odds of having low SF-36 MH scores decreased in men with MetS as age increased, and no association between MetS and low SF-36 MH scores in women were identified.[34] Additionally, a systematic review indicates MetS status is significantly related to the overall quality of life as measured by the SF-36, and improvements were observed after intensive lifestyle intervention.[35] The relationship between SF-36 scores and ecSI 2.0™ scores has not been established in individuals with MetS or well-people. However, SF-36 scores are positively correlated with other measures of eating behaviors (Questionnaire of Eating Behavior) in women aged 50 to 64.[36] Increased research into the relationship between both SF-36 MH and ecSI 2.0™ and SF-36 VT and ecSI 2.0™ scores in individuals with MetS is needed.

Associations with Perceived Stress Scale (PSS)

An association between PSS scores and MetS, as well as the components of MetS, is well established in the literature.[37,38,39] Janczura et al.[38] found PSS scores to be significantly higher in individuals with MetS. In studies where associations between higher PSS scores and MetS have been made, higher levels of stress increase the prevalence of MetS.[38] In general, lower levels of perceived stress have been associated with positive eating behaviors.[39,40,41] Those with increased perceived stress reported less intuitive eating, and more uncontrolled, emotional eating than

those with less perceived stress.[40] Other measures of eating behavior , e.g., the Three Factor Eating Questionnaire, were negatively associated with PSS scores in a sample of normal weight and overweight individuals with no history of chronic disease.[41] Both low ecSI 2.0™ scores and high PSS scores were associated with increased adiposity and weight in college freshman.[42] Additionally, higher levels of perceived stress have been identified as a variable that negatively influences eating competence levels in a generally healthy sample.[39] PSS scores and eating competence were inversely related in overweight and obese persons (84% female) living in Finland.[40] However, it remains unclear if the relationship between ecSI 2.0™ scores and perceived stress levels, as assessed by the PSS, is applicable to individuals with chronic illnesses, such as MetS.

Associations with Patient Health Questionnaire (PHQ)

Research indicates the relationship between obesity and depression, as well as the association of depression and MetS diagnosis and risk factors.[34,43,44,45,46] Additionally, individuals with both obesity and MetS have higher rates of depression than those who only have depression or MetS.[41] The association between MetS and depressive symptoms as measured with PHQ are stronger in women than men.[34,43] Additionally, individuals with depressive symptoms are at increased risk to develop MetS than individuals without depressive symptoms.[47,48] The association with PHQ scores and ecSI 2.0™ is not established in individuals with MetS. However, adolescents who score high on the PHQ tend to engage in unhealthy eating habits.[49] Additionally, depressive symptoms were associated with high prevalence of disordered eating.[50] More research is needed to investigate if the association of depressive symptoms and eating habits extends to ecSI 2.0™ scores in individuals with MetS. One study that provides an

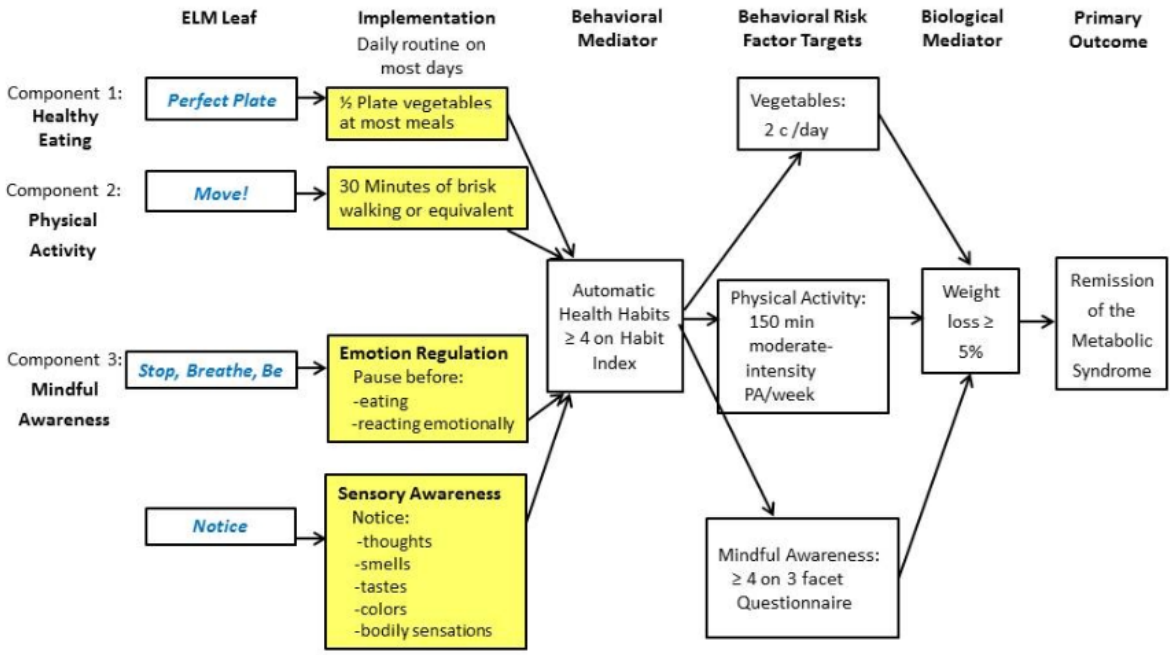
opportunity to examine the relationship of EC tenets and biopsychosocial factors in persons with MetS is the ELM study.

Enhanced Lifestyles for Metabolic Syndrome (ELM) Study

The ELM study is a multi-site, randomized, controlled, lifestyle clinical trial that aims to compare the efficacy and financial impact of two intervention delivery methods on remission of MetS.[51] The two delivery methods of lifestyle intervention investigated are 1) a Group-Based arm and 2) a Self-Directed arm.

The Group-Based arm aims to achieve sustained lifestyle changes through the development of 4 habits that ultimately become automatic in daily life. The Group-Based arm is a three-component treatment that targets diet, physical activity, and mindful awareness. Each of these three components is translated into an ELM Leaf, representing each of the habits.[51] The hypothesized pathway guiding the Group-Based arm is shown in Figure 1 below. The Group-Based lifestyle treatment is meant to mimic activities that produced old habits and provide the opportunity to replace these habits with new alternatives.[52]

Figure 1. The hypothesized pathway for the Group-Based program[51]



90-minute group meetings with an intervention team consisting of a health psychologist, a registered dietitian, and a health coach are held with approximately 15 participants. These meetings are held weekly for the first 3 months and bi-weekly for the next 3 months, during the intensive phase. Participants meet monthly for the final 18 months of the study during the maintenance phase.[51] All sessions within the intensive phase include a set of activities intended to bring focus to forming new habits. Participants work out, prepare a vegetable dish, and eat while participating in an experiential learning exercise. During the maintenance phase, meetings are participant-led and are intended to broaden their health network.[51]

The Self-Directed arm serves as an enhanced version of the current treatment provided.[51] This serves as a clinically relevant comparator to serve as a comparison of efficacy to the group-based arm. In this arm of the study, educational tip sheets are sent to participants on a

monthly basis.[41] The tip sheets sent to participants include clear guidelines and behavioral targets that are endorsed by the American Heart Association, American Diabetes Association, United States Department of Agriculture, and the Academy of Nutrition and Dietetics.[51] Participants in the Self-Directed arm are provided with a Fitbit to self-monitor their physical activity, in addition to access to the ELM website that contains other educational materials and information.[51] Once participants have been randomized into the Self-Directed arm, participants meet with a coordinator to introduce themselves to the components of the Self-Directed arm and to undergo training to use the Fitbit and ELM website. The coordinator is available to the participants throughout the study as a reference for questions about the study.[51]

Benefits and problems are associated with both approaches. Group-based interventions present opportunities for being cost-effective because of the nature of treating a group of individuals, as opposed to one individual at a time.[53] Additionally, groups provide mechanisms of action for behavioral change, such as social learning and modeling.[53] These mechanisms are lacking in a self-directed approach. Group-based approaches require many resources such as personnel, facilities for meetings, and more time involvement than present in a self-directed approach. However, self-directed approaches require resources for printing and mailing materials.[53]

Inclusion criteria for the ELM study are being positive for having three or more of the five components of MetS. These components are 1) a waist circumference of ≥102 cm for men and ≥88 cm for women, 2) triglycerides ≥150 mg/dL or treatment for elevated triglycerides, 3) high-density lipoprotein (HDL) cholesterol <40 mg/dL in men and <50 mg/dL in women, or treatment for low HDL, 4) systolic blood pressure of ≥130 mmHg, diastolic blood pressure ≥85 mmHg, or treatment for hypertension, and 5) fasting plasma glucose 100-125 mg/dL or on

metformin. Additionally, participants must be 18 years or older.[51] Four cohorts of 30 participants undergo the intervention.

ELM study data are collected at baseline, post-intensive intervention (PII), mid-maintenance (MM), and final phases of the study. Components of the data assessments may be found in Table 1, below.

Table 1. Assessments completed during data collection.[51]

Assessment	Description of Instrument
ecSI 2.0™	Self-report measure of eating attitudes and behaviors[2]
Demographics	Self-reported data describing the population
Lipid Panel	Measure of triglycerides, total cholesterol, HDL-cholesterol, and LDL-cholesterol in blood
Blood Glucose Level	Measure of amount of glucose in blood
HgA1c	Measure of glycated hemoglobin, reflects average blood sugar level for past two to three months[54]
Perceived Stress Scale (PSS)	Self-report survey to measure the degree to which situations in life are considered stressful [55]
Depression: Patient Health Questionnaire (PHQ-8)	Self-report diagnostic and severity measure for depressive disorders[56]
Blood Pressure	Average of 3 seated resting blood pressure measurements using NHANES protocol.[57]
Waist Circumference	Measured with SECA 201 tape measure, following NHANES waist circumference assessment guidelines.[58]
Weight	Measured in kilograms with a Seca 876 flat scale[59]
Height	Measured in centimeters with a Seca 213 stadiometer[59]

Quality of Life: Short Form Health Survey (SF-36)	36-item self-report survey to assess health status[60]
USDA Food Security	Measure of ability to access enough food for an active, healthy life[61]

Conclusion

The associations of eating competence with biopsychosocial measures have been studied and supported in a general, healthy population. This suggests the need to establish these findings can be generalized to a population with chronic diseases, such as those with MetS.

Study Goals

This thesis aims to test if tenets of eating competence and relationship to bioclinical and psychosocial attributes in a general population are also evident in a sample with MetS. Specifically, this study will be investigating the relationships between ecSI 2.0™ scores and PSS, SF-36 Mental Health (SF-36 MH) and Vitality (SF-36 VT), PHQ-8, body mass index (BMI), blood glucose (BG), triglycerides, systolic and diastolic blood pressure, and HDL-C. Confounding variables to be assessed include gender, race, and food security status. Data will be used that were collected at baseline and post-intensive intervention (PII) phases of the ELM lifestyle modification program from the Rochester site.

METHODOLOGY

Study Design

The present study is secondary data analysis utilizing data that were collected from the clinical randomized trial, Enhanced Lifestyles for Metabolic Syndrome (ELM). Details of this trial can be found at ClinicalTrials.gov, identifier NCT04036006.[62] ELM is a multisite clinical trial investigating the efficacy of a group-based intervention versus that of a self-directed intervention on individuals with metabolic syndrome. Only data from the Rochester site were utilized in the present study.

Recruitment of Participants

Participants were not recruited by this researcher but the data that were utilized were from the ELM study. ELM researchers at RIT recruited these participants using three strategies: 1) electronic medical records, 2) referral by a medical provider, and 3) self-referral.[51] Through the use of an algorithm, medical records were interrogated to identify patients with probable MetS, no diagnosis of Type II Diabetes, 18 years of age or older, and English speaking.[51] The individuals identified were then sent a letter with the option of opting out of a recruitment phone call. Referrals by medical providers include the posting of recruitment materials in medical clinics or clinic-specific activities developed by a provider as a local champion.[51] Self-referral recruitment includes internet-based recruitment, advertisements, Facebook, and mass media utilized to reach interested participants directly.[51]

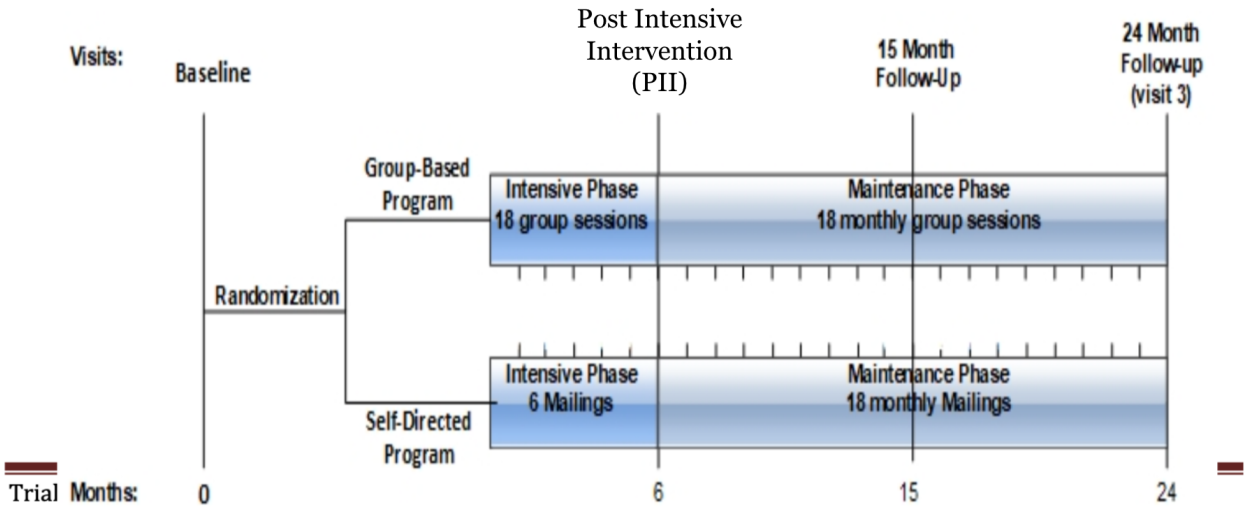
All participants signed a consent form prior to data collection. Participants met with a research assistant in person at the Rochester Institute of Technology, where they were provided

with all information pertaining to the study, including what was expected out of their participation, what is to be expected during data collection, and disclosure statements about the privacy of the information that was to be collected. The consent form was outlined to each participant by the research assistant, and the individual was provided an opportunity to ask questions. All participants voluntarily signed a consent form to continue in the ELM study.

Data Collection

Data were collected at baseline and PII timepoints. Baseline testing was conducted between November 4, 2019 and February 7, 2020. An additional assessment was conducted between baseline and PII testing, in response to delays caused by the COVID-19 pandemic. This was completed in June 2020. PII testing was conducted between January 18, 2021 and March 1, 2021. The timeline of the ELM study can be found in Figure 2, below.

Figure 2. Timeline of the Enhanced Lifestyles for Metabolic Syndrome Study[51]



Demographic data and all psychosocial data were collected via self-report questionnaires. Questionnaires were administered as three separate sets of surveys and administered to participants by a research assistant. The items for each Set are located in Appendix 1-3. At baseline, all surveys were administered in person. At PII Sets 1 and 2 were both administered via Zoom, and Set 3 was administered in person. Surveys administered in person were projected onto a screen so participants and research assistants could view the questions together. For surveys administered via Zoom, the research assistant utilized the screen sharing feature so participants could view the survey. The research assistant read through all questions with the participant, as the participant stated their answer. As the participant stated their answer, the research assistant filled in the answer on the survey program. All physical measures (i.e, blood pressure, waist circumference, height, and weight) were performed in person by a research assistant on the RIT campus. The 12-hour fasting blood collection was performed in person by a phlebotomist with Rochester Regional Health on RIT campus and analyzed by Quest Diagnostics.

Biomedical Data Collection

12-Hour Fasting Blood Draw

A 12-hour fasting blood draw was performed. Serum glucose, hemoglobin A1c, and a lipid panel (to obtain HDL-C, Total Cholesterol, LDL-C and triglycerides) tests were conducted using standard procedures by Quest Laboratories.[63] LDL-C was estimated using the Martin-Hopkins calculation, a validated method providing greater accuracy in the estimation of LDL-C levels than other methods.[64] Fasting glucose tests measure the amount of glucose in the

blood plasma at the given time point. Hemoglobin A1c measures the amount of glycated hemoglobin and gives a measurement of the levels of blood glucose levels preceding several weeks.[65]

Blood Pressure

Blood pressure was measured with an OMRON HEM- 907XL digital blood pressure monitor.[59] The procedure for collecting blood pressure data are as follows. The participant must not have had any food, caffeinated beverages, nicotine, or alcohol within the 30 minutes preceding measurement.[59] The right arm is preferred for measurement, however, if the participant is unable to utilize the right arm for measurement the left arm should be used. Proper cuff size is determined through the following measurement. Using a tape measure, the midpoint of the arm is determined by measuring the length between the acromion and olecranon processes.[59] The midpoint of this measurement is marked with a washable marker and the circumference of the arm is measured at this midpoint. The blood pressure cuff size is determined by the measured arm circumference (small: 17.0-22.0cm; medium: 22.1-32.0cm; large: 32.1-42.0cm; extra-large: 42.1-50.0cm).[59] Using the proper blood pressure cuff size, the cuff is positioned over the brachial artery at least one inch above the crease of the elbow. The participant should be seated with legs uncrossed and arm resting on a table with the palm facing upwards. The blood pressure machine will begin taking measurements after a five-minute rest period. Three measurements of systolic blood pressure, diastolic blood pressure, and pulse are recorded with one minute rest time between measurements.[59] The average of the three measurements was calculated to determine the participant's systolic and diastolic blood pressure.[59]

Waist Circumference

Waist circumference was measured with a Seca 201 tape measure.[59] The participant crosses their arms or places their hands on opposite shoulders. The research assistant then palpates the participant's right hip for the iliac crest and marks the uppermost portion with a washable marker.[59] The measuring tape is then extended horizontally around the participant's waist at the level of the mark. The measuring tape is kept snug to the skin and parallel to the floor. Participants are asked to take a deep inhale and exhale. Measurement is taken on exhale to the nearest 0.1 cm.[59] This measurement is repeated once more. If the difference between the two measurements is greater than 1.0 cm, a third measurement is taken.[59] The average of all measurements was calculated to determine the participant's waist circumference.

Height

Height was measured with a Seca 213 stadiometer to the nearest 0.1 cm.[59] Participants should remove shoes and any hair, jewelry, or accessories from the top of the head. The participant stands straight against the backboard of the stadiometer. Bodyweight should be evenly distributed between both feet and heels, buttocks, shoulder blades, and head are ensured to be in contact with the backboard.[59] The stadiometer headpiece is lowered to rest on the top of the participant's head by the research assistant. The participant is instructed to take a deep breath and measurement is recorded to the nearest 0.1 cm on the inhale. This is protocol repeated once more for a second measurement.[59] If the two measurements are different by 0.5 cm or greater, the

steps are repeated for a third measurement.[59] The average of all measurements was utilized to determine the participant's height.

Weight

Weight was measured with a Seca 876 flat scale. Participants remain wearing clothing, removing their shoes, belts, extra layers of clothing (i.e. sweaters, sweatshirts), and objects from their pockets.[59] The scale is powered on and the participant steps on the center of the scale with hands at their sides and looking straight forward after a zero value is observed.[59] Measurement is recorded to the nearest 0.1 kg.[59] This is repeated once more for the second weight measurement. If the two measurements are different by 0.2 kg or greater, a third measurement is recorded.[59] The average of all measurements was calculated to determine the participant's weight.

Psychosocial Instruments

Satter Eating Competence Inventory™

The ecSI 2.0™, is a self-report measure of eating competence.[14] ecSI 2.0™ has been validated in a general sample of adult men and women.[18] ecSI 2.0™ has test-retest reliability, indicating the usefulness in measuring the impact of eating-competence focused interventions.[18,66] ecSI was restructured into ecSI/LI, and validated for use in low income women.[24] ecSI/LI, renamed ecSI 2.0™, has been supported for use within a general adult audience, regardless of income.[21] Therefore, the ecSI 2.0™ may be utilized to measure eating competence among socioeconomic diverse populations.[13] Additionally, ecSI 2.0™ has been

validated for use in other populations, such as Brazilian, Finnish, and Taiwanese individuals.[20,67,68] As well as ecSI 2.0™ use in adolescent populations.[20] Because of ecSI 2.0™ test-retest reliability and vast validation, the use of this measure in tailoring eating competence-focused interventions is identified, which may be applied to individuals with MetS. The internal consistency was demonstrated with a Chronbach alpha of 0.81 at baseline and 0.83 at PII.

Short Form-36

The SF-36 was designed for use in clinical practice and research to survey the health status of individuals.[60] The SF-36 is one of the most widely used instruments measuring health-related quality of life.[47] The survey was constructed to be either a self-administered survey for individuals 14 years or older or for administration by an interviewer.[60] The SF-36 consists of a multi-item scale assessing eight subscale categories. These categories are: 1) limitations in physical activities resulting from health issues, 2) limitations in social activities resulting from physical or emotional issues, 3) limitations in usual roles resulting from physical issues, 4) bodily pain, 5) general mental health, 6) limitation in usual roles resulting from emotional problems, 7) vitality, and 8) general health perception.[60] Despite the growing number of scientific literature utilizing an SF-36 total score, research and SF-36 developers do not support the use of the SF-36 total score for measuring the quality of life, indicating this increased error.[69] Rather the use of individual categorical scores increase validity and provide researchers with accurate measures of health-related quality of life.[69] Each category is scored from 0 to 100, with 0 indicating poor health and 100 indicating very good health.[34,70]

The SF-36 has demonstrated sensitivity to the impact of disease and treatments as identified in clinical trials in individuals with hypertension, prostate disease, and obesity.[43,60] The SF-36 has been validated for use with morbidly obese individuals and has identified the mental health and vitality subscales as being specifically relevant measures in the obese population.[43] The internal consistency of SF-36 MH was demonstrated with a Chronbach alpha of 0.58 at baseline and 0.84 at PII. The internal consistency of the SF-36 VT was demonstrated with a Chronbach alpha of 0.84 at baseline and 0.81 at PII.

Perceived Stress Scale

The Perceived Stress Scale (PSS) is a measure of the degree to which situations in an individual's life are deemed as stressful.[55] The PSS was designed for use with individuals with at least a junior high school education, and the questions are relatively general and adequate for most populations and groups.[55] The PSS has internal and test-retest reliability and has been established as a better predictor of health and health-related outcomes when compared to alternative, similar measures.[55] Additionally, PSS has substantial validity that was unaffected by sex or age.[55] Because of the adequate validity and reliability of this measure, PSS has proven effective in examining the role of stress levels in the etiology of diseases, such as MetS.[55] The PSS total scores range from 0 to 56 and are categorized into two categories: 1) low stress (score 0-19), and 2) high stress (score 19-56).[55] The internal consistency was demonstrated with a Chronbach alpha of 0.84 at baseline and 0.89 at PII.

Patient Health Questionnaire-8

PHQ-8 is a well-established, valid self-report diagnostic and severity measure for depressive disorders.[56] PHQ-8 is validated for use within large clinical studies, as well as smaller clinical populations.[56,71] PHQ-8 is scored on a scale of 0 to 27 and into five categories: none - minimal depression (scores of 0-4), mild depression (scores of 5-9), moderate depression (scores of 10-14), moderately severe depression (scores of 15-19), and severe depression (scores of 20-27).[56] The internal consistency was demonstrated with a Chronbach alpha of 0.69 at baseline and 0.88 at PII.

USDA Food Security Scale

USDA Food Security Scale measures the ability of an individual to access enough food to support an active, healthy lifestyle.[61] The USDA 10-item Food Security Scale is scored on a scale of 0-10 and categorized into four categories based on score: high food security (score of 0), marginal food security (score of 1-2), low food security (score of 3-5), and very low food security (score of 6-10).[72] Categories of high and marginal food security are considered food secure and categories of low or very low food security are considered food insecure.[72]

Data Analysis

Each instrument was scored, summed or calculated according to directions. Each biomedical parameter was grouped into normal vs high [triglycerides (normal <150 mg/dL); systolic (normal < 130 mmHg) and diastolic blood pressure (normal < 85mmHg); glucose (

normal < 100mg/dL)] or normal vs. low (HDL-Cholesterol; male low <40 mg/dL; female low < 50 mg/dL). Self report measures were categorized by score as follows: PHQ-8: none-minimal depression (0-4), mild-moderate depression (5-14); PSS: low stress (0-19), high stress (20-56). Participants were categorized as eating competent (total ecSI 2.0 ≥32) or not eating competent (total ecSI 2.0 <32). Based on low response to some options race and food security were grouped as white or non-white, and high or marginal food security.

Statistical analyses were performed with SPSS statistical analysis software version 26.[73] A significance level of ≤0.05 was used in all analyses. The normality of the distribution of each variable was analyzed through the use and consideration of results from Q-Q plots, histograms, skewness, and kurtosis values. Skewness and kurtosis values between +1 and -1 were considered as normally distributed. The ecSI 2.0™ had a normal distribution, but non-parametric analyses were utilized to be conservative because of the small sample size.[74] The reliability of each psychosocial measure (e.g., ecSI 2.0™, SF-36 MH, SF-36 VT, PSS, PHQ-8) was analyzed using Cronbach's alpha. Mean ecSI 2.0™ and subscale score means were compared between the categorized values for stress, depression, and bioclinical groups using Mann Whitney U tests at baseline and PII timepoints (e.g., high vs normal triglycerides). Differences between males and females, white and non-white, or food secure vs marginally food secure were analyzed using Mann Whitney U tests. GLM univariate tests were conducted to control for any demographic differences when comparing eating competence scores and bioclinical or psychosocial findings as shown in Table 2. Literature supports the use of controls for the confounding demographic differences (e.g., HDL-C, triglycerides, blood glucose, systolic blood pressure, PHQ-8).[16,75] Spearman correlation coefficients were assessed for relationships between continuous variables (e.g., waist circumference, BMI, SF-36 MH, SF-36 VT.)

RESULTS

Table 2. Confounder and corresponding variables for GLM univariate tests

Confounder	Baseline	PII
Gender	HDL-C Blood glucose	Systolic BP
Race	Blood glucose Triglycerides PHQ-8	Triglycerides
Food Security	Systolic BP	

Table 3. Baseline and Post-Intensive Intervention demographic information participants with diagnosed metabolic syndrome enrolled in a clinical trial

Characteristic	Baseline (n=31)		Post-Intensive Intervention (n=28)	
	n	%	n	%
Gender				
Female	17	55	15	54
Race				
Balck or African American	3	9	2	7
Caucasian/White	26	84	24	85
Other	1	3	1	4
Refused	1	3	1	4
Highest Education Level				
High School Diploma	1	3	1	4

Some College or Associate Degree	8	26	8	28
4-year College	13	42	12	43
Master's Degree	9	29	7	25
Employment Status				
Employed Full Time	21	68	18	64
Employed Part Time	3	10	3	11
Retired	7	22	7	25
	M	SD	M	SD
Age	57.9	9.7	58.3	10.1
Body Mass Index	37.7	6.5	36.2	8.0
Total ecSI 2.0[1]	29.3	6.8	32.0	6.3
Eating Attitude and Behavior	12.2	3.3	13.1	2.9
Food Acceptance	4.7	1.4	5.2	1.7
Internal Regulation	3.7	1.5	3.5	1.0
Contextual Skills	8.6	2.9	10.2	2.6

[1]Measured with ecSI 2.0™ Total scores may range from 0 – 48; Eating Attitudes and Behavior may range from 0-18; Food Acceptance may range from 0-9; Internal Regulation may range from 0-6; Contextual Skills may range from 0-15

Description of Participants

Participants were predominantly white. Both genders were evenly represented. distributed. The age of participants ranged from 28 to 74 years of age. Most participants are college graduates and most are employed full time. As anticipated by the study inclusion criteria, all participants were either overweight or obese. Demographics information may be found in Table 3.

Three participants left the study between baseline and PII. Of these three individuals, two were female, two were white, and two had a Master's degree. The ages of those who left are 49, 56, and 58. All three participants were employed full-time. The age of the remaining participants ranged from 28 to 74 years and BMI ranged from 23 to 58.

Table 4. Satter Eating Competence Inventory 2.0 and subscale scores at baseline (BSL) and post-intensive intervention (PII) by biopsychosocial measure category[1]

Biopsychosocial Measure		Satter Eating Competence Inventory™ [2] Total Score	Eating Attitudes and Behavior	Food Acceptance	Internal Regulation	Contextual Skills
HDL-Cholesterol						
BSL	Low(n=15)	27.4±6.8	11.9±3.5	4.5±1.2	3.5±1.6	7.5±2.9
	Normal(n=16)	31.0±6.6	12.6±3.2	4.9±1.6	4.0±1.4	9.5±2.6
PII	Low(n=12)	30.6±5.9	12.3±3.0	5.1±1.6	3.3±1.2	9.9±2.5
	Normal(n=15)	33.1±6.6	13.7±2.7	5.3±1.8	3.8±0.8	10.5±2.8
Triglycerides						
BSL	High(n=17)	29.2±7.3	12.2±3.3	4.8±1.6	3.7±1.4	8.7±3.1
	Normal(n=14)	29.3±6.4	12.3±3.4	4.7±1.3	3.9±1.7	8.4±2.8
PII	High(n=11)	32.0±7.2	12.9±3.6	5.6±1.4	3.6±0.9	9.9±3.2
	Normal(n=16)	32.0±5.9	13.2±2.3	5.0±1.9	3.4±1.1	10.4±2.2
Systolic Blood Pressure						

BSL	High(n=15)	31.3±6.1	13.0±2.1	4.9±1.2	4.1±1.3	9.3±3.2
	Normal(n=16)	27.4±7.2	11.5±4.1	4.6±1.6	3.4±1.6	7.8±2.5
PII	High(n=9)	34.7±5.4	14.1±2.5	6.1±1.1	3.7±0.7	10.8±2.9
	Normal(n=18)	30.7±6.4	12.6±3.0	4.8±1.8	3.4±1.1	9.9±2.5
Diastolic Blood Pressure						
BSL	High(n=13)	28.6±4.2	12.4±2.0	4.9±1.2	3.7±1.4	7.6±2.3
	Normal(n=18)	29.7±8.3	12.1±4.0	4.6±1.6	3.8±1.6	9.2±3.2
PII	High(n=6)	34.8±5.0	14.2±2.1	6.2±1.3	3.8±0.4	10.7±3.3
	Normal(n=21)	31.2±6.5	12.8±3.0	5.0±1.7	3.4±1.1	10.1±2.5
Blood Glucose						
BSL	High(n=12)	29.9±5.6	12.6±2.8	4.6±1.0	4.3±1.4	8.5±2.9
	Normal(n=19)	28.8±7.6	12.0±3.6	4.8±1.6	3.4±1.5	8.6±3.0
PII	High(n=12)	34.3±5.0	14.2±1.9	5.8±1.7	3.8±1.2	10.7±2.4
	Normal(n=14)	30.1±7.0	12.3±3.3	4.7±1.6	3.3±0.8	9.9±2.9

Patient Health Questionnaire-8						
BSL	None- Minimal(n=27)	**30.3±6.4**	**12.8±2.8**	4.9±1.4	3.8±1.5	8.8±2.9
	Mild(n=4)	**22.0±5.7**	**8.3±3.8**	3.8±1.3	3.3±1.5	6.8±2.6
PII	None-Minimal(n=24)	32.9±5.9	13.5±2.7	5.5±1.5	3.5±1.1	10.1±2.7
	Mild(n=3)	25.0±5.6	10.0±2.6	3.3±2.5	3.3±0.6	8.3±0.6
Perceived Stress Scale						
BSL	Low(n=15)	**31.4±7.7**	**13.3±3.4**	4.7±1.4	3.8±1.5	9.5±3.5
	High(n=16)	**27.3±5.4**	**11.2±2.9**	4.8±1.4	3.7±1.5	7.6±2.0
PII	Low(n=12)	34.5±5.6	14.3±2.3	5.6±1.2	3.2±1.0	**11.5±2.6**
	High(n=15)	30.0±6.3	12.1±3.0	4.9±2.0	3.7±1.0	**9.2±2.2**
Short Form-36 Mental Health[3]						
BSL	ρ	**0.56**	**0.63**	0.13	0.30	**0.38**
PII	ρ	0.44	0.35	0.37	-0.23	0.55

Short Form-36 Vitality[3]						
BSL	ρ	**0.61**	**0.46**	**0.48**	**0.44**	**0.40**
PII	ρ	**0.65**	**0.54**	**0.55**	0.13	**0.59**
Body Mass Index[3]						
BSL	ρ	-0.09	-0.05	-0.01	-0.18	-0.25
PII	ρ	0.06	0.06	0.07	0.10	-0.04
Waist Circumference[3]						
BSL	ρ	-0.14	-0.13	-0.18	**-0.42**	-0.33
PII	ρ	0.06	0.05	0.10	-0.10	0.08

[1] Category values as follows: HDL-Male low < 40 mg/dL, Female low < 50 mg/dL; Triglycerides-High ≥ 150 mg/dL; Systolic BP-High≥130 mm Hg; Diastolic BP- High≥85 mmHg; Blood Glucose- High 100-125 mg/dL; Patient Health Questionnaire-None-Minimal 0-4, Mild 5-9; Perceived Stress Scale- Low 0-18, Moderate 19-37. Table entries are mean±standard deviation
[2] Measured with ecSI 2.0™ Total scores may range from 0 – 48; Eating Attitudes and Behavior may range from 0-18; Food Acceptance may range from 0-9; Internal Regulation may range from 0-6; Contextual Skills may range from 0-15
[3] Spearman rho Correlation

Table 5. Association of eating competence and measure compared at baseline and post-intensive intervention (PII)[1]

Biopsychosocial Measure	Satter Eating Competence Inventory™ [2] Total Score	Eating Attitudes and Behavior	Food Acceptance	Internal Regulation	Contextual Skills
HDL-Cholesterol[3]					
Baseline	0.30	0.60	0.40	0.47	0.11
PII	0.22	0.24	0.58	0.40	0.72
Triglycerides[3]					
Baseline	0.98	0.95	1.0	0.65	0.74
PII	0.87	0.58	0.51	0.48	0.83
Systolic Blood Pressure[3]					
Baseline	0.22	0.40	0.71	0.40	0.20
PII	0.25	0.053	0.53	0.60	0.16
Diastolic Blood Pressure[3]					
Baseline	0.44	0.86	0.65	0.62	0.16
PII	0.32	0.16	0.38	0.76	0.22
Blood Glucose[3]					
Baseline	0.73	0.77	0.51	0.18	0.68
PII	0.11	0.12	0.12	0.23	0.37

Patient Health Questionnaire-8[3]					
Baseline	**0.03**	**0.03**	0.14	0.55	0.21
PII	0.07	0.08	0.16	0.74	0.19
Perceived Stress Scale[3]					
Baseline	**0.05**	**0.03**	0.90	0.92	0.06
PII	0.09	0.08	0.43	0.18	**0.03**
Waist Circumference[4]					
Baseline	0.47	0.49	0.33	**0.02**	0.07
PII	0.77	0.80	0.62	0.64	0.68
Body Mass Index[4]					
Baseline	0.62	0.78	0.96	0.33	0.18
PII	0.78	0.77	0.72	0.61	0.84
Short Form-36 Mental Health[4]					
Baseline	**0.001**	**<0.001**	0.49	0.10	**0.03**
PII	**0.02**	0.07	0.06	0.24	**0.003**
Short Form-36 Vitality[4]					
Baseline	**<0.001**	**0.01**	**0.01**	**0.01**	**0.03**

PII	**<0.001**	**0.004**	**0.003**	0.53	**0.001**

[1] Table entries are P values.
[2]Measured with ecSI 2.0™ Total scores may range from 0 – 48; Eating Attitudes and Behavior may range from 0-18; Food Acceptance may range from 0-9; Internal Regulation may range from 0-6; Contextual Skills may range from 0-15
[3]Mann Whitney U test
[4]Spearman rho correlation
Significant

Table 6. Biopsychosocial measures at baseline and post-intensive intervention (PII) by eating competent and non-eating competent status.[1]

Biopsychosocial Measure	Eating Competent[2] (Baseline: n=15; PII: n=13)	Non-Eating Competent[2] (Baseline: n=16; PII: n=14)	p value[3]
HDL-Cholesterol			
Baseline	47.8±8.0	45.7±11.0	0.45
PII	50.9±8.9	45.5±9.6	0.16
Triglycerides			
Baseline	162.1±56.5	156.0±76.6	0.74
PII	129.5±60.3	151.1±104.1	0.72
Systolic Blood Pressure (mmHg)			
Baseline	132.5±16.9	122.7±13.6	0.22
PII	126.4±17.5	123.1±12.1	0.69
Diastolic Blood Pressure (mmHg)			
Baseline	79.9±10.7	81.4±9.1	0.65
PII	76.6±11.3	77.6±8.7	0.55
Blood Glucose (mg/dL)			
Baseline	98.4±11.0	99.3±11.6	0.86
PII	103.7±10.2	97.0±14.2	0.09

Body Mass Index			
Baseline	37.9±7.1	37.7±6.2	0.98
PII	36.4±7.7	36.0±8.4	0.69
Waist Circumference (cm)			
Baseline	117.6±13.8	122.4±14.1	0.45
PII	112.3±14.3	112.4±3.8	0.87
Patient Health Questionnaire-8[4]			
Baseline	1.1±1.2	2.9±2.5	**0.02**
PII	1.0±1.2	3.6±3.6	**0.02**
Perceived Stress Scale[4]			
Baseline	16.7±5.6	21.3±5.5	**0.02**
PII	16.1±5.9	23.1±5.9	**0.01**
Short Form-36 Mental Health[4]			
Baseline	85.0±5.7	77.2±11.3	**0.04**
PII	83.9±10.2	72.9±17.3	0.08
Short Form-36 Vitality[4]			
Baseline	69.2±12.4	50.0±18.8	**0.003**
PII	73.1±13.1	54.9±19.3	**0.01**

[1]Table entries are mean±standard deviation.
[2]Eating Competent- Total ecSI 2.0™ score of 32 or greater. Non-Eating Competent- Total ecSI 2.0™ <32
[3]P value from Mann Whitney U test
[4]Possible scores for each measure: PHQ-8: 0-27; PSS: 0-56; SF-36 MH: 0-100; SF-36 VT: 0-100.

Sociodemographic Factors

Food Security

Baseline

At baseline, all participants were food secure, however, five participants were marginally food secure and 26 were food secure with no one being food insecure. Total ecSI 2.0™ and subscale scores did not differ between high and marginal food security [(Total ecSI 2.0™: high- 29.8±6.5, marginal- 26.0±8.3, P=0.20); (EA subscale: high- 12.6±2.9; marginal- 10.2±4.7; P=0.77); (FA subscale: high- 4.8±1.5; marginal- 4.6±1.1; P=0.62); (IR subscale: high- 3.8±1.4; marginal- 3.4±1.9; P=0.55); (CS subscale: high- 8.7±3.0; marginal- 7.8±2.3; P=0.36)]. Additionally, food security status (high vs marginal) was not related to eating competent status (i.e., ecSI 2.0™<32 or 32 and higher) (EC: n=15; non-EC: n=16; P= 0.40).

Follow-up

The current study did not investigate food security status at the PII timepoint. However, at the COVID assessment, 30 participants were highly food secure and one individual was marginally food secure. All five marginally food secure at baseline now had high food security status and one individual moved from high food security status to marginal food security status. Given the COVID assessment outcomes, there were likely changes in food security status at PII in the direction of increased food security.

Gender

Baseline

The sample consisted of 17 females and 14 males. Total ecSI 2.0™ and subscale scores did not differ between males and females [(Total ecSI 2.0™: male- 29.9±5.5; female- 28.8±7.9);

(EA subscale: male- 13.0±2.7; female- 11.5±3.7); (FA subscale: male- 4.4±1.6; female- 5.1± 1.2); (IR subscale: male- 4.0±1.1; female- 3.5±1.8); (CS subscale: male- 8.5±3.2; female- 8.6± 2.8)].

Follow-up

At PII, the sample included 15 females and 13 males. Total ecSI 2.0™ and subscale scores did not differ between males and females [(Total ecSI 2.0™: male- 31.2±5.5, female- 32.8 ±7.1); (EA subscale: male- 12.6±2.4, female- 13.5±3.3); (FA subscale: male- 5.4±1.9, female- 5.1±1.5); (IR subscale: male- 3.3±0.9, female- 3.6±1.2); (CS subscale: male- 9.9±1.9, female- 10.6±3.2)]. The characteristics of those who did not complete follow-up surveys are noted in the demographics section.

Education

Baseline

Education levels ranged from only a high school diploma to graduate degrees (Table 3). Total ecSI 2.0™ and subscales did not differ among education levels[(Total ecSI 2.0™: high school diploma: 29.0, n=1; Associates degree: 25.5±7.8, n=8; college graduate: 29.0±5.4, n=13; Master's degree: 33.0±6.6, n=9; P=0.26); (EA subscale: high school diploma: 13.0, n=1; Associates degree: 10.8±3.9, n=8; college graduate: 12.0±3.2, n=13; Master's degree: 13.8±2.6, n=9; P=0.38); (FA subscale: high school diploma: 5.0, n=1; Associates degree: 4.6±1.5, n=8; college graduate: 4.8±1.6, n=13; Master's degree: 4.8±1.3, n=9; P=0.99); (IR subscale: high school diploma: 6.0, n=1; Associates degree: 3.1±2.0, n=8; college graduate: 3.9±1.1, n=13; Master's degree: 3.9±1.4, n=9; P=0.0.37); (CS subscale: high school diploma: 5.0, n=1;

Associates degree: 7.0±3.1, n=8; college graduate: 8.4±2.2, n=13; Master's degree: 10.6±2.8, n=9; P=0.10)].

Follow-up

Diverse education levels continued to be included, however, the three who didn't continue with the study had higher education levels. CS subscale scores tended to be higher in those with Master's degrees than all other education categories (high school diploma: 10.0, n=1; Associates degree: 9.4±3.1, n=7; college graduate: 9.4±2.4, n=12; Master's degree: 12.4±1.4, n=7; P=0.054). Total ecSI 2.0™ and all other subscale scores did not differ among different education levels [(Total ecSI 2.0™: high school diploma: 33.0, n=1; Associates degree: 30.9± 6.4, n=7; college graduate: 30.2±6.5, n=12; Master's degree: 36.1±4.9, n=7; P=0.26); (EA subscale: high school diploma: 5.0, n=1; Associates degree: 12.3±3.7, n=7; college graduate: 12.5±2.5, n=12; Master's degree: 14.6±2.4, n=7; P=0.37); (FA subscale: high school diploma: 6.0, n=1; Associates degree: 5.3±1.1, n=7; college graduate: 4.9±2.3, n=12; Master's degree: 5.6±1.1, n=7; P=0.93); (IR subscale: high school diploma: 2.0, n=1; Associates degree: 3.9±1.1, n=7; college graduate: 3.3±0.9, n=12; Master's degree: 3.6±1.1, n=7; P=0.33)].

Race

Baseline

Total ecSI 2.0™ and subscales scores did not differ between white [(Total ecSI 2.0™: 29.1±7.1); (EA subscale: 12.2±3.2); (FA subscale: 4.7±1.5); (IR subscale: 3.6±1.5); (CS subscale: 8.6±3.1)] and non-white participants [(Total ecSI 2.0™: 30.2±6.0); (EA subscale: 12.6 ±4.0); (FA subscale: 5.0±1.2); (IR subscale: 4.4±1.7); (CS subscale: 8.2±1.5)].

Follow-up

Total ecSI 2.0™ and subscale scores did not differ between white [(Total ecSI 2.0™: 31.9 ±6.5); (EA subscale: 13.0±3.0); (FA subscale: 5.2±1.7); (IR subscale: 3.5±0.9); (CS subscale: 10.1±2.8)] and non-white participants [(Total ecSI 2.0™: 32.8±5.7); (EA subscale: 13.3±2.1); (FA subscale: 5.3±2.2); (IR subscale: 3.5±1.7); (CS subscale: 10.8±1.7)].

Biopsychosocial Measures

HDL Cholesterol

Baseline

HDL-C levels ranged from 29 mg/dL to 65 mg/dL. Fifteen participants had low HDL-C (male <40 mg/dL; female <50 mg/dL), 16 had normal HDL-C. HDL-C was significantly higher in females than males (female: 50.5±8.0, n=17; male: 42.1±9.5, n=14; P=0.02). HDL-C continued to be significantly higher in females, even when controlling for ecSI 2.0™ scores. HDL-C did not differ between high food secure and marginally food secure (high: 46.7±10.2, n=26; marginal: 46.6±5.9, n=5; P=1.0) or between white and non-white participants (white: 46.2±9.9, n=26; non-white: 49.4±7.7, n=5; P=0.42).

Total ecSI 2.0™ and subscale scores did not differ between low and normal HDL-C (Table 4, Table 5). HDL-C did not differ between EC and non-EC eaters (Table 6), even when controlling for gender. HDL-C was not correlated with ecSI 2.0™ scores [(Total ecSI 2.0™: ρ=0.21; P=0.26); (EA subscale: ρ=-0.03; P=0.88); (FA subscale: ρ=0.30; P=0.10); (IR subscale: ρ=0.14; P=0.47); (CS subscale: ρ=0.30; P=0.10)].

Follow-up

HDL-C levels ranged from 29 mg/dL to 63 mg/dL. 12 participants had low HDL-C and 15 had normal HDL-C. Unlike baseline values, males and females did not differ in HDL-C (female: 51.5±8.2, n=14; male: 44.3±9.5, n=13; P=0.06). Additionally, HDL-C did not differ by white or non-white (white: 47.6±.6, n=23; non-white: 51.0±8.9, n=4; P=0.45)

Total ecSI 2.0™ and subscale scores did not differ between low and normal measurements of HDL-C (Table 4, Table 5). Additionally, HDL-C did not differ between EC and non-EC participants (Table 6). HDL-C was not correlated with total or subscale ecSI 2.0™ scores [(Total ecSI 2.0™: ρ=0.15; P=0.47); (EA subscale: ρ=0.14; P=0.50); (FA subscale: ρ=-0.12; P=0.54); (IR subscale: ρ=0.18; P=0.37); (CS subscale: ρ=0.10; P=0.63)].

Triglycerides

Baseline

Triglyceride levels ranged from 65 mg/dL to 398 mg/dL. 17 participants had high triglycerides(≥150 mg/dL) and 14 had normal triglycerides (<150 mg/dL). Triglycerides were significantly higher in white participants versus those of non-white participants (white: 169.1± 67.1, n=26; non-white: 106.2±30.9, n=5; P=0.01). Triglyceride levels were not different between males and females (male: 165.4±84.7, n=14; female: 153.6±49.2, n=17; P=0.83) or between high and marginally food secure participants (high: 160.1±71.5, n=26; marginal: 153.0±35.1, n=5; P=0.90).

Total ecSI 2.0™ and subscale scores did not differ between high and normal triglyceride values (Table 4, Table 5). Triglycerides did not correlate with ecSI 2.0™ or subscales [(Total ecSI 2.0™: ρ=0.07; P=0.70); (EA subscale: ρ=0.03; P=0.88); (FA subscale: ρ=0.07; P=0.73); (IR

subscale: ρ=-0.07; P=0.72); (CS subscale: ρ=0.15; P=0.42)]. Additionally, triglycerides did not differ between EC and non-EC individuals (Table 6), even when controlling for race.

Follow-up

At PII, triglyceride levels ranged from 59 mg/dL to 469 mg/dL. Eleven participants had triglycerides ≥150 mg/dL and 16 had triglycerides <150 mg/dL. Triglycerides were significantly higher in white participants versus non-white (white: 150.6±87.1, n=23; non-white: 83.8±42.3, n=4; P=0.02). Additionally, triglycerides did not differ between males or females (male: 141.5± 109.5, n=13; female: 139.9±58.0, n=14; P=0.50).

Total ecSI 2.0™ and subscale scores were not significantly different between high and normal triglycerides (Table 4, Table 5). Triglycerides were not correlated with total ecSI 2.0™ or subscales [(Total ecSI 2.0™: ρ=0.04; P=0.84); (EA subscale: ρ=0.07; P=0.74); (FA subscale: ρ=0.10; P=0.62); (IR subscale: ρ=0.28; P=0.16); (CS subscale: ρ=-0.13; P=0.53)], even when controlling for race. Triglyceride levels did not differ between EC and non-EC individuals (Table 6) as well as when controlling for race.

Systolic Blood Pressure

Baseline

Systolic blood pressure ranged from 99 mmHg to 162 mmHg. 15 participants had high systolic blood pressure (≥130 mmHg) and 16 had normal systolic blood pressure. Systolic blood pressure was significantly higher in high food security status individuals (high: 131.0± 14.6, n=26; marginal: 109.2±6.8, n=5; P=0.002). Systolic blood pressure did not differ between white and non-white individuals (white: 128.9±16.1, n=26; non-white: 120.2±13.0, n=5; P=0.36) or males and females(male: 132.3±9.8, n=14; female: 123.5±18.8, n=17; P=0.09).

Total ecSI 2.0™ and subscale scores did not differ between high and normal systolic blood pressure (Table 4, Table 5), even when controlling for food security status. Systolic blood pressure was positively correlated with total ecSI 2.0™ (ρ=0.37; P=0.04) and the EA subscale (ρ=0.37; P=0.04), even when controlling for food security status. Systolic blood pressure was not correlated with other ecSI 2.0™ subscales [(FA subscale: ρ=0.11; P=0.55); (IR subscale: ρ=0.22; P=0.23); (CS subscale: ρ=0.31; P=0.09)]. Additionally, systolic blood pressure did not differ between EC or non-EC participants (Table 6), even when controlling for food security status.

Follow-up

Systolic blood pressure ranged from 103 mmHg to 160 mmHg. Nine participants had high systolic blood pressure (≥130 mmHg) and 18 had normal systolic blood pressure. Systolic blood pressure was significantly higher in males than females (male: 129.7±12.1, n=13; female: 120.0±15.9, n=14; P=0.03). Systolic blood pressure did not differ between white and non-white individuals(white: 125.1±15.6, n=23; non-white: 122.3±9.7, n=4; P=0.87).

EA subscale scores tended to be higher in individuals with high systolic blood pressure. Total ecSI 2.0™ and subscale scores were not different between high and normal systolic blood pressure (Table 4, Table 5). Total ecSI 2.0™ and subscales were not correlated with systolic blood pressure [(Total ecSI 2.0™: ρ=0.27; P=0.17); (EA subscale: ρ=0.26; P=0.20); (FA subscale: ρ=0.38; P=0.051); (IR subscale: ρ=0.10; P=0.62); (CS subscale: ρ=0.12; P=0.56)]. Systolic blood pressure did not differ between EC and non-EC individuals (Table 6).

Diastolic Blood Pressure

Baseline

Diastolic blood pressure ranged from 65 mmHg to 99 mmHg. Diastolic blood pressure did not differ among categories of gender (male: 80.0±0.5, n=14; female: 81.3±10.9, n=17; P=0.74), race (white: 81.7±9.7, n=26; non-white: 75.8±9.4, n=5; P=0.28), or food security status (high: 82.1±9.9, n=26; marginal: 73.6±5.3, n=5; P=0.06).

Total ecSI 2.0™ and subscale scores did not differ between high and normal diastolic blood pressure (Table 4, Table 5). Diastolic blood pressure was not correlated with total ecSI 2.0™ or subscale scores[(Total ecSI 2.0™: ρ= -0.05; P=0.78); (EA subscale: ρ= -0.03; P=0.88); (FA subscale: ρ=0.02; P=0.92); (IR subscale: ρ= -0.12; P=0.56); (CS subscale: ρ= -0.01; P=0.96)]. Additionally, diastolic blood pressure did not differ between EC or non-EC (Table 6).

Follow-up

Diastolic blood pressure ranged from 64 mmHg to 97 mmHg. Diastolic blood pressure did not differ between males and females (male: 76.2±10.5, n=13; female: 78.0±9.5, n=14; P=0.55), and white and non-white individuals (white: 77.8±10.4, n=23; non-white: 73.3±4.3, n=4; P=0.62).

Total ecSI 2.0™ and subscale scores did not differ between high and normal diastolic blood pressure readings (Table 4, Table 5). Diastolic blood pressure did not differ between eating competent and non-eating competent individuals (Table 6). Diastolic blood pressure was not correlated with ecSI 2.0™ or any subscale scores [(Total ecSI 2.0™: ρ=-0.01; P=0.97); (EA subscale: ρ=0.01; P=0.96); (FA subscale: ρ=0.13; P=0.52); (IR subscale: ρ=0.09; P=0.66); (CS subscale: ρ=-0.16; P=0.44)].

Blood Glucose

Baseline

BG ranged from 78 mg/dL to 123 mg/dL. BG was significantly higher in non-white individuals (white: 97.1±10.2, n=26; non-white: 108.2±12.0, n=5; P=0.04) and significantly higher in males (male: 102.8±9.5, n=14; female: 95.7±11.6, n=17; P=0.03). Fasting BG did not differ between marginal and high food secure participants (high: 99.6±10.0, n=26; marginal: 95.2±16.8, n=5; P=0.28).

Total ecSI 2.0™ and subscale scores did not differ among normal and high BG (Table 4, Table 5), even when controlling for race and gender. BG did not differ among EC and non-EC participants (Table 6), even when controlling for race and gender. BG was not correlated with total ecSI 2.0™ and subscale scores [(Total ecSI 2.0™: ρ=0.13; P=0.49); (EA subscale: ρ=0.17; P=0.36); (FA subscale: ρ=-0.09; P=0.62); (IR subscale: ρ=0.32; P=0.08); (CS subscale: ρ=-0.08; P=0.67)]. Correlations remained non-significant when controlling for gender and race.

Follow-up

BG levels ranged from 79 mg/dL to 130 mg/dL. Fasting BG did not differ between white and non-white participants (white: 98.7±12.8, n=23; non-white: 109.0±7.9, n=4; P=0.10) or between males and females (male: 104.4±14.7, n=13; female: 96.4±9.4, n=14; P=0.20).

Total ecSI 2.0™ and subscale scores did not differ among normal and high BG Table 4, Table 5). BG did not differ between EC and non-EC individuals (Table 6). BG was positively correlated with FA subscale scores (ρ=0.41; P=0.04). BG was not correlated with total ecSI 2.0™ and other subscales [(Total ecSI 2.0™: ρ=0.33; P=0.09); (EA subscale: ρ=0.27; P=0.18); (IR subscale: ρ=0.12; P=0.57); (CS subscale: ρ=0.22; P=0.26)].

Body Mass Index

Baseline

BMI ranged from 28 to 55. One participant was categorized as overweight and 30 participants were categorized as obese. BMI did not differ between high and marginal food security individuals (high: 37.9±7.0, n=26; marginal: 37.3±4.1, n=5; P=0.78), males and females (male: 36.0±5.2, n=14; female: 39.2±7.3, n=17; P=0.16), or white and non-white individuals (white: 38.3±7.0, n=26; non-white: 35.3±1.8, n=5; P=0.62).

BMI was not correlated with ecSI 2.0™ or subscale scores (Table 4, Table 5). BMI did not differ between EC and non-EC participants (Table 6).

Follow-up

BMI ranged from 23 to 58. One participant was categorized as normal weight, four participants were categorized as overweight and 22 participants were categorized as obese. BMI did not differ between males and females (male: 33.2±5.0, n=13; female: 39.0±9.3, n=14; P=0.07), or white and non-white individuals (white: 36.6±8.6, n=23; non-white: 33.9±1.5, n=4; P=0.82).

BMI was not correlated with ecSI 2.0™ or subscale scores (Table 4, Table 5). BMI did not differ between EC and non-EC participants (Table 6).

Waist Circumference

Baseline

Waist circumference ranged from 96 cm to 152 cm. Thirty participants had high waist circumference (i.e., > 88 cm females, >102 cm males); only one had normal waist circumference. Waist circumference did not differ between high and marginal food secure individuals (high:

119.7±14.3, n=26; marginal: 122.1±13.0, n=5; P=0.78), males and females (male: 119.7±10.1, n=14; female: 120.4±16.8, n=17; P=0.54), or white and non-white individuals (white: 121.1± 14.7, n=26; non-white: 115.0±8.5, n=5; P=0.42).

Waist circumference was inversely correlated with the IR subscale score (Table 4, Table 5). Waist circumference was not correlated with ecSI 2.0™ or other subscale scores (Table 4, Table 5). Waist circumference did not differ between EC or non-EC participants (Table 6).

Follow-up

Waist circumference ranged from 83 cm to 143 cm. Twenty-two participants had high waist circumference and four individuals had normal waist circumference. Waist circumference did not differ between males and females (male: 111.2±12.6, n=13; female: 113.5±15.2, n=14; P=0.69), or white and non-white individuals (white: 113.2±14.5, n=23; non-white: 107.7±8.1, n=4; P=0.41).

Waist circumference was not correlated with ecSI 2.0™ or subscale scores (Table 4, Table 5). Waist circumference did not differ between EC or non-EC (Table 6).

Patient Health Questionnaire-8 - Depressive Symptoms

Baseline

PHQ-8 scores ranged from 0 to 8. Depressive symptoms were more apparent in white than non-white participants (PHQ-8 scores white: 2.4±2.2, n=26; non-white: 0.2±0.4, n=5; P=0.005). PHQ-8 scores did not differ between highly and marginally food secure (high: 1.9± 1.9, n=26; marginal: 2.8±3.6, n=5; P=0.98) or between males and females (male: 1.6±2.1, n=14; female: 2.4±2.2, n=17; P=0.28).

Total ecSI 2.0™ and EA subscale (but not the other three subscales) scores were significantly lower in those with mild depression than those with no or minimal depressive symptoms (Table 4, Table 5), even when controlling for race. More depressive symptoms were correlated with lower total ecSI 2.0™ (ρ= -0.41; P=0.02) and IR subscale (ρ= -0.37; P=0.04), but not the other subscales [(EA subscale: ρ=-0.35; P=0.052); (FA subscale: ρ=-0.26; P=0.15); (CS subscale: ρ=-0.24; P=0.20)], even when controlling for race. EC participants had lower levels of depression than those who were non-EC (Table 6), even when controlling for race.

Follow-up

PHQ-8 scores ranged from 0 to 11. PHQ-8 scores did not differ between white and non-white participants (white: 2.4±3.1, n=24; non-white: 1.5±1.7, n=4; P=0.73) or males and females (male: 1.9±2.9, n=13; female: 2.7±3.0, n=15; P=0.29).

Total ecSI 2.0™ and subscale scores did not differ between categories of PHQ-8 scores (Table 4, Table 5). PHQ-8 scores were inversely correlated with total ecSI 2.0™ (ρ=-0.51; P=0.01), EA (ρ=-0.51; P=0.01), and CS (ρ=-0.58; P=0.002) subscales, but not the other subscales [(FA subscale: ρ=-0.35; P=0.08); (IR subscale: ρ=0.19; P=0.35)]. EC participants had lower levels of depression than non-EC (Table 6).

Perceived Stress

Baseline

PSS scores ranged from 7 to 30. Perceived stress scores did not differ between white and non-white (white: 18.6±6.1, n=26; non-white: 21.8±4.4, n=5; P=0.31), males and females (male: 18.6±5.4, n=14; female: 19.5±6.5, n=17; P=0.54), or high and marginal food security status (high: 18.7±6.1, n=26; marginal: 21.4±5.2, n=5; P=0.36).

Total ecSI 2.0™ and EA subscale scores were lower in participants who perceived high stress (Table 4, Table 5). EC participants perceived less stress than non-EC (Table 6). PSS scores negatively correlated with ecSI 2.0™ (ρ=-0.53; P=0.002), EA (ρ=-0.53; P=0.002), and CS (ρ=-0.44; P=0.01) subscale scores. All other ecSI 2.0™ subscale scores were not correlated with PSS [(FA subscale: ρ=-0.13; P=0.49); (IR subscale: ρ=-0.20; P=0.28)].

Follow-up

Perceived stress scores ranged from 9 to 33. Perceived stress did not differ among males and females (male: 19.4±5.8, n=13; female: 20.1±8.0, n=14; P=0.62), or white and non-white participants (white: 19.7±7.1, n=23; non-white: 19.8±5.1, n=4; P=0.87).

CS subscale scores were significantly higher in participants with low perceived stress (Table 4, Table 5). Total ecSI 2.0™ and other subscale scores did not differ between perceived stress levels(Table 4, Table 5). EC had lower levels of perceived stress than non-EC (Table 6). Perceived stress scale scores are negatively correlated with total ecSI 2.0™ (ρ=-0.53; P=0.005), EA (ρ=-0.49; P=0.01), and CS (ρ=-0.59; P=0.001) subscale scores. ecSI 2.0™ IR (ρ=0.24; P=0.22) and FA (ρ=-0.34; P=0.09) subscale scores were not correlated with PSS.

Short Form-36 Mental Health Scale

Baseline

SF-36 MH subscale scores ranged from 55 to 90. SF-36 MH did not differ between high and marginal food security status (high: 82.5±8.4, n=26; marginal: 73.0±13.0, n=5; P=0.10), males and females (male: 82.9±9.1, n=14; female: 79.4±10.1, n=17; P=0.32), or white and non-white individuals (white: 80.8±10.4, n=26; non-white: 82.0±5.7, n=5; P=0.86).

SF-36 MH was positively correlated with total ecSI 2.0™ and EA and CS subscales (Table 4, Table 5). SF-36 MH was not correlated with other subscales (Table 4, Table 5). SF-36 MH scores were significantly higher in EC individuals than non-EC (Table 6).

Follow-up

SF-36 MH subscale scores ranged from 35 to 95. SF-36 MH did not differ between males and females (male: 81.2±11.0, n=13; female: 76.0±17.6, n=15; P=0.65), or white and non-white individuals (white: 77.9±15.1, n=24; non-white: 81.3±15.5, n=4; P=0.64).

SF-36 MH scores were positively correlated with total ecSI 2.0™ scores and CS subscale (Table 4, Table 5). SF-36 MH scores were not correlated with other subscales (Table 4, Table 5). SF-36 MH did not differ between EC and non-EC individuals (Table 6).

Short Form-36 Vitality Scale

Baseline

SF-36 VT subscale scores ranged from 13 to 88. SF-36 VT did not differ between high and marginal food security status (high: 59.1±18.1, n=26; marginal: 60.0±22.8, n=5; P=0.94), males and females (male: 59.4±13.4, n=14; female: 59.2±22.3, n=17; P=0.77), or white and non-white individuals (white: 58.7±17.9, n=26; non-white: 62.5±23.8, n=5; P=0.58).

SF-36 VT scores were positively correlated with total ecSI 2.0™ and all subscale scores (Table 4, Table 5). SF-36 VT scores were higher in EC individuals than non-EC (Table 6).

Follow-up

SF-36 VT subscale scores ranged from 19 to 88. SF-36 VT did not differ between males and females (male: 67.8±14.2, n=13; female: 60.8±21.6, n=15; P=0.47), or white and non-white individuals (white: 63.0±19.0, n=24; non-white: 70.3±16.4, n=4; P=0.51).

SF-36 VT scores were positively correlated with total ecSI 2.0™, and EA, FA, and CS subscales (Table 4, Table 5). SF-36 VT was not correlated with the IR subscale (Table 4, Table 5). SF-36 VT scores were significantly higher in EC individuals than non-EC (Table 6).

Non-Parametric Tests versus Parametric Tests

Parametric testing did not yield significantly different results than non-parametric. At baseline, the only difference observed in parametric testing was a trend towards significance in HDL-C and CS subscales (P= 0.06) that was not observed with non-parametric testing (P=0.11). Otherwise, no significant differences were observed in parametric versus non-parametric testing at baseline.

At PII, parametric testing yielded significant results for the PHQ-8 analyses and total ecSI 2.0™, EA, and FA subscales [(Total ecSI 2.0™: P=0.04); (EA: P=0.05); (FA: P=0.04)], compared to no significant findings with non-parametric testing [(Total ecSI 2.0™: P=0.70); (EA: P=0.08); (FA: P=0.16)]. Additionally, parametric tests yielded a trend towards significant difference in FA subscale when analyzed by systolic blood pressure (P=0.052) that was not observed in non-parametric testing (P=0.53).

DISCUSSION

Summary

This study aimed to examine if tenets of eating competence and relationship to biopsychosocial attributes previously described in a general population are also evident in a

sample with MetS. The tenets of eating competence include positive eating attitudes, food acceptance, internal regulation of food intake, and management of eating context.[14] Individuals who are eating competent are secure with their enjoyment of food and eating and dependable about getting enough to eat.[14] A relationship was present between some biopsychosocial attributes and the tenets of eating competence. Specifically, those with higher scores on ecSI 2.0™ tended to have lower stress, less depressive symptoms, greater mental health, and greater vitality. Findings did not support a relationship between eating competence and HDL-C, triglycerides, blood pressure, blood glucose, BMI, and waist circumference.

Total ecSI 2.0™ and subscale scores were similar to those of previous studies. Psota et al.[16] report hypercholesteremic adults having average ecSI 2.0™ scores around the range of those observed in the present study. However, Psota et al.[16] reported a lower percentage of EC participants. Additionally, Tilles-Tirkkonen et al.[20] reported similar average ecSI 2.0™ scores for a sample of adults with Type 2 Diabetes Mellitus. Similar to Psota et al.[16], Tilles-Tirkkonen et al.[20] reported a lower percentage of EC participants than the present study.

The sample was predominantly white, mostly well-educated, obese or overweight, and had high or marginal food security. Males and females were evenly represented. Sample demographics were similar to those at other ELM research sites. The multi-site ELM sample is predominantly white, well-educated, and overweight or obese.[76] However, nationally the ethnicity of persons living with MetS differs from the ELM sample. Data collected for the NHANES questionnaire between 2011-2016 showed most individuals reporting three or more risk factors for MetS having “other” race and ethnicity, followed by Hispanic individuals, and then non-Hispanic white individuals.[32] Similar to the ELM study Rochester site, females and males were evenly represented in the population of individuals with MetS.[32] Since the

demographics of this mostly white, educated sample differ from the general characteristics of the MetS population, findings about the relationships between eating competence and MetS may not be generalizable to the MetS population.

Sociodemographic Factors

Eating Competence Examined by Race

The present study did not find any differences in total ecSI 2.0™ and subscale scores between white and non-white participants. These findings are consistent with a study involving a sample of adult females with no chronic illness, finding no differences in eating competence among races.[21] Despite the consistency of findings with previous studies, the present study consisted of mostly white participants. The lack of variability of race within participants decreases the generalizability of findings between race and eating competence to the general population of MetS.

Eating Competence Examined by Gender

No differences in total ecSI 2.0™ and subscale scores were present between males and females. These findings differ from those of Brown et al.[17] who found males' total ecSI, EA, FA, and IR subscale scores to be significantly higher than those of females. Additionally, Clifford et al.[25] found college-aged males to have higher total ecSI scores. Similarly, Rodgers et al.[77] found college-aged males to score higher on EA, FA, IR subscales. Tanja et al.[78] found adolescent female participants were more likely to have higher ecSI scores and be EC. However, findings were similar to those reported by Lee et al.[72], where no differences were found in ecSI scores by gender in a sample of elderly Taiwanese individuals.

Eating Competence Examined by Food Security

ecSI 2.0™ and food security status were not associated, which differs from Lohse & Masters'[79] finding of a negative correlation between ecSI 2.0™ scores and food security in a sample of mostly overweightor obese participants, with one-third being food insecure. Lohse et al.[79] also reported higher ecSI 2.0™ scores for those with high or marginal food security. ecSI 2.0™ was validated for use regardless of income and possible food resource issues in samples without chronic disease.[21] Thus, it is expected that no differences in ecSI 2.0™ scores and food security status be present, as it has been adjusted and validated for use regardless of individuals' food security status. Therefore, the lack of association between ecSI 2.0™ and food security status in the present study is not unexpected.

Biopsychosocial Measures

Eating Competence Examined by HDL-Cholesterol

Similar to other studies, HDL-C was higher in females than males.[16] Psota et al.[16] found females to have higher HDL-C than males. This may be explained by the positive effects the sex hormone estrogen has on HDL-C levels.[80] Of note are the differences in the inclusion criteria for males and females for HDL-C. Because HDL-C is known to be higher in females, female inclusion criteria for HDL-C was 10 mg/dL higher than male inclusion criteria. This was considered when grouping the sample as "normal" and low HDL-C (males: <40 mg/dL, females: <50 mg/dL), reflecting the differences in HDL-C by gender.

No significant differences in ecSI 2.0™ and subscale scores between low and normal measurements of HDL-C were present. Additionally, HDL-C did not differ between EC and

non-EC participants. In contrast, studies from Lohse et al.[81] and Tilles-Tirkkonen et al.[20] found EC individuals to have higher HDL-C than non-EC individuals. No correlations between HDL-C and ecSI 2.0™ scores were present. This differs from findings reported by Psota et al.[16], who found positive correlations between HDL-C and total ecSI and FA scores. Eating competence has been associated with healthier food options and a better cardiovascular profile.[16,81] Therefore, the results presented in this study do not align with the expected outcome based on results from the general population. HDL-C is found to be lower in individuals with insulin resistance or Type 2 Diabetes.[82] One of the risk factors of MetS is insulin resistance, therefore, this may play a role in the lack of relationship between HDL-C and ecSI 2.0™ in individuals with MetS.

Eating Competence Examined by Blood Pressure

Systolic blood pressure was positively correlated with total ecSI 2.0™ and EA subscale scores at baseline, that is, those with higher blood pressure had higher total ecSI 2.0™ and EA subscale scores. However, at PII total ecSI 2.0™ or subscales were not correlated with systolic blood pressure. This could be related to a change in only 1 or 2 participants, which cannot be examined because of the cross-sectional rather than longitudinal design of the data. Evidence of some change from baseline to PII is also evident because at PII, but not baseline, systolic blood pressure was significantly higher in males than females. No significant findings between ecSI 2.0™ and DBP were present at baseline or PII. In previous studies, eating competence has been shown to be linked with lower blood pressure overall in a sample of hypercholesteremic adults.[16] Psota et al.[16] reported a significant inverse relationship between both systolic and diastolic blood pressure and total ecSI 2.0™, EA, and IR subscales scores. Additionally, Psota et al.[16] found diastolic blood pressure to be significantly lower in females than males, however, this

relationship was not present in the sample. The findings presented within this study may not provide an accurate picture of the relationship between blood pressure and eating competence, as one of the inclusion factors for the study was either having high blood pressure or being prescribed blood pressure regulating medications, constraining the variability in the sample.

Eating Competence Examined by Triglycerides

Triglycerides were higher in white (n=26) than non-white (n=5) participants at both baseline and PII. The limited number of non-white participants likely confounds the examination of the relationship between race, eating competence and triglycerides in this study. However, findings from the National Health and Nutrition Examination Survey (NHANES) 2003-2006 data from 2003-2006 showed similar findings of non-Hispanic white individuals having higher triglycerides.[75]

No other associations between ecSI 2.0™ and triglycerides were present. This is unexpected as being eating competent has been associated with better cardiovascular health[16], and increased triglycerides have been associated with decreased cardiovascular health.[83] These findings contradict those of Psota et al.[16] who found a trend to an inverse relationship between triglyceride levels and total ecSI, FA, and CS subscale scores, as well as findings from Tilles-Tirkkonen et al,[20] reporting an inverse association between CS subscale scores and triglyceride levels in individuals. The findings from the current sample with MetS do not align with previous literature, however, further examination with a larger, more diverse sample will be required for continued examination of the relationship between eating competence and triglycerides in individuals with MetS.

Eating Competence Examined by Blood Glucose

At baseline, blood glucose was higher in non-white than white participants and higher in males. These findings are consistent with findings from Psota et al.[16], where males had higher blood glucose than females. The differences in blood glucose and gender may be explained by the differences in body composition, as well as hormonal differences, between males and females that affect the homeostasis of plasma glucose.[84]

At PII, those with higher FA subscale scores also had higher blood glucose levels. This would indicate those with greater food acceptance and higher variety within their diet, have higher blood glucose than those who do not.[14] BG did not differ between EC and non-EC participants. This is congruent with findings from Tilles-Tirkkonen et al.[20] who found no differences in glucose levels by EC vs non-EC. However, these results do not align with findings in a sample of Spanish elderly participants where EC individuals were more likely to have lower fasting blood glucose levels.[81] Eating competence has been associated with lower sugar intake.[16] However, one of the components of MetS is insulin resistance, indicating the sample may have decreased ability to properly regulate their plasma glucose, leading to heightened fasting glucose levels. Of note is that one of the inclusion criteria for the present study is a fasting glucose level between 100 and 125 mg/dL or being on metformin. Individuals on metformin will have better-controlled blood glucose levels regardless of eating habits. Therefore, the results obtained in the study may not accurately depict the true relationship between blood glucose and ecSI 2.0™ scores in individuals with MetS.

Eating Competence Examined by Waist Circumference

Waist circumference was inversely correlated with IR subscale scores at baseline. IR

subscale measures the ability to respond to internal cues of hunger, satiety, and appetite. Effective internal regulation results in the stabilization of body weight at a proper level for that individual.[14] Therefore, this may extend to the idea that higher IR subscale scores be related to lower waist circumference, as these individuals are more likely to be at a level of optimum health and weight.[14] Similarly, Tilles-Tirkkonen et al.[20] found CS subscale scores to be inversely associated with waist circumference. No other associations between waist circumference and ecSI 2.0™ or other subscale scores were present at baseline or PII. This is contradictory to findings from Lohse et al.[85] who reported that premenopausal women with the lowest ecSI scores had the highest waist circumference. However, with one exception, the ELM sample had a high waist circumference. Therefore, a relationship between waist circumference and ecSI 2.0™ may be more apparent in a sample with MetS with more variability in waist circumference.

Eating Competence Examined by Body Mass Index

No significant associations between BMI and ecSI 2.0™ and subscale scores were observed. This is congruent with Psota et al[16] who reported no significant differences in BMI between EC and non-EC participants but contrasts with previous findings of high BMIs in non-EC.[19,20,25,81] Additionally, previous findings establish CS subscale scores being inversely associated with BMI.[20] Lohse et al.[85] also report individuals with the lowest tertile of ecSI scores had the highest BMI when assessing a population of premenopausal women. At baseline, the present study consisted of BMI categories of overweight and obese, and at PII only one participant was categorized as having normal weight. Therefore, the relationship between BMI and ecSI 2.0™ tenets may be better observed in a sample consisting of more BMI variability. However, this is difficult because the MetS population is more likely to have a higher BMI,

especially with increasing the amount of MetS risk factors.[75]

Eating Competence Examined by Patient Health Questionnaire -8

Total ecSI 2.0™ and EA subscale scores were significantly lower in those with mild depression than those with no or minimal depressive symptoms, as assessed by the PHQ-8. Additionally, total ecSI 2.0™, EA, and IR subscales scores were inversely correlated with PHQ-8 scores, meaning that the higher the ecSI 2.0™ scores, the fewer depressive symptoms reported. The relationship between eating competence and depression may be highly sensitive because individuals with probable major depression (PHQ-8 > 10) were excluded from the study because they would not be suitable for group treatment.[51] Therefore, the present study was unable to explore the relationship between depressive symptoms and eating competence in participants with severe depression. The relationship observed between PHQ-8 and ecSI 2.0™ aligns with findings from Bächle et al. [50] who found depressive symptoms more likely to occur with eating disorder symptomology in young adults with Type-1 diabetes. Of note is that eating competence has been shown to be associated with lower scores on the Eating Disorder Inventory.[18,24] Therefore, the results observed may be explained by the relationship between depressive symptoms and poor eating behaviors. Another such triangulation is noted with emotional eating, depression, and eating competence. Lazarevich et al.[86] found depressive symptoms to be associated with more emotional eating in Mexican college students and lower levels of emotional eating have been reported for eating competent persons.[18,24] Individuals with depression often experience poor eating habits, including more episodes of binge eating, emotional eating, or disordered eating.[87] Thus, it follows that lower eating competence scores in individuals reporting more depressive symptoms may not be unexpected in a sample with MetS.

Eating Competence Examined by Perceived Stress Scale

At baseline, total ecSI 2.0™ and EA subscale scores were higher in those with lower stress and at PII, CS subscale scores were higher in those with low stress. At both baseline and PII, PSS scores were negatively correlated with total ecSI 2.0™, EA, and CS subscale scores, suggesting individuals with lower stress have higher total ecSI 2.0,™ EA, and CS subscale scores. These findings are consistent with findings from Joseph et al.[41] who found higher levels of perceived stress to be related to higher scores on the disinhibition scale of the TFEQ, indicating those with higher stress are less likely to exhibit healthy eating behaviors. Additionally, Hootman et al[42] report that greater stress was a strong predictor of unhealthy food consumption. The relationship between perceived stress and eating behaviors may be explained by a physiological response to stressors. When subjected to greater levels of chronic stress, an individual will begin to exhibit a preference for more energy-dense foods, in larger amounts.[88] Therefore, the relationships observed between PSS and ecSI 2.0™ in individuals with MetS aligns with established findings in the literature from samples of a general population.

Eating Competence Examined by Short Form - 36 Mental Health Scale

SF-36 MH was positively correlated with total ecSI 2.0™, EA, and CS subscale scores; that is, participants who scored higher on the SF-36 MH subscale scored higher on total ecSI 2.0,™ EA, and CS subscales. This is consistent with findings from a study of 16 to 29-year-old Danish women, with those having more risk behaviors for eating disorders tending to have lower mental health quality of life than those without risk behaviors, as measured by the SF-36 MH.[89] Intuitive eating behaviors have also been positively associated with several psychological health

indicators, indicating individuals who utilize intrinsic signals (i.e. hunger and satiety) to guide their food intake reported having better mental health.[90]

The relationship between ecSI 2.0™ and SF-36 MH may have several explanations. EC persons have been associated with positive sleep behaviors in a study assessing college students.[19] Additionally, positive sleep behaviors are widely associated with increased mental health.[91,92,93] It is possible the positive correlation between mental health and ecSI 2.0™ is related to better sleep quality experienced by EC persons. Additionally, EC persons are less likely to exhibit emotional eating, indicating those reporting better mental health are less likely to have poor eating habits.[24] Thus, the relationship observed between ecSI 2.0™ and SF-36 MH scale in the present sample with MetS is not unexpected.

Eating Competence Examined by Short Form - 36 Vitality Scale

Higher scores on the SF-36 VT subscale were associated with higher scores on ecSI 2.0™ and all subscale scores. Additionally, EC individuals had significantly higher SF-36 VT scores. This aligns with a study of 16 to 29-year-old Danish females, that found those who exhibit eating behaviors that increase the risk for eating disorders scored lower on SF-36 VT subscales than those without risky eating behaviors.[89] Additionally, a study involving Finnish and German adults utilizing the TFEQ-R18 observed associations with individuals scoring lower on emotional eating and uncontrolled eating to have higher vitality, as measured by the vitality index scale, as well as reporting increased contentment with eating.[94] Concepts from the TFEQ align with those of ecSI 2.0™, therefore, it is not unexpected ecSI 2.0™ and SF-36 VT also be associated in individuals with MetS.[18]

Limitations

This study has several limitations. The small sample size may not be adequate to detect the actual relationship between ecSI 2.0™ and biopsychosocial factors in individuals with MetS. In several bioclinical factors (e.g., waist circumference, BMI, blood pressure), there was little variability within the sample. Decreased variability caused difficulty when assessing the relationship between ecSI 2.0™ and bioclinical values. Additionally, the sample was predominantly white, well-educated, and food secure. This is not congruent with a study utilizing 2011-2016 NHANES data that found individuals with MetS to be predominantly non-white[32], indicating the data may not be generalizable to the entire MetS population. No paired measures were utilized in this study, so we were unable to assess the changes in eating behaviors across baseline and PII timepoints. In addition, the treatment group of each participant was unknown, therefore any conclusion as to the impact of treatment on the relationships between biopsychosocial and EC tenets could not be made. The COVID-19 pandemic occurred during the time between baseline and PII data collection. This pandemic may have impacted eating behaviors and responses to surveys (i.e. PSS, PHQ-8) as the pandemic may have caused a significant disruption in participant's lives. Despite these limitations, there remain several strengths of this study.

Strengths

Strengths of this study include the confirmed diagnosis of MetS in participants. This ensures the findings of this study apply to individuals with MetS. The utilization of valid surveys and measurement techniques increases the likelihood of accurate, sound data. In addition, laboratory values for blood work were derived using valid methods and provided from a

national, licensed laboratory (Quest Diagnostics). There were approximately 11 months between baseline data collection and PII data collection thus facilitating examination of two separate time points.

Future Research and Implications

This study indicates that there is a relationship between EC tenets and some biopsychosocial measures in individuals with MetS, specifically lower stress, less depressive symptoms, and better mental and physical health as measured by the SF-36 MH and SF-36 VT. Future research can be conducted utilizing a larger, more diverse sample to increase the reliability and generalizability of the results. Further analyses of these data utilizing a longitudinal design and paired data statistics controlling for treatment will be necessary to conduct a more genuine examination of relationships of eating competence with bioclinical factors in persons with MetS. Further research in this area will assist in tailoring an approach to the treatment for reversal and maintenance of MetS, such as increased nutrition education aimed at improving eating competence.

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APPENDIX 1

ELM Set 1 Baseline

Participant ID ____ ____ ____ ____ ____ ____ ____ ____

Date of Form ____ ____/____ ____/ 2 0 ____ ____
M M D D Y Y

Staff Name _____

Visit Baseline = V1 __V1

In this section, we ask some basic questions about you.

1. What gender do you identify as
   Female = 1
   Male = 2
   Non-binary/third gender = 3
   Prefer to self-describe(Specify_____) = 4
   Prefer not to say = 5
   ____

1a. What sex were you assigned at birth?
   Female = 1
   Male = 2
   Intersex = 3
   ____

2. What is your current relationship status?
   Single = 1
   Living with partner= 2
   Living with spouse = 3
   Living separately from spouse = 4
   Divorced = 5
   Widowed = 6
   Refused = 8
   ____

3. How many years of school you have completed? (0 if never attended) ____

4. What is the highest degree you earned?
   Less than high school = 1
   Regular High School Diploma =2
   GED or alternative credential =3
   Vocational or training school after high school=4
   Some College or Associate Degree =5
   College graduate or Baccalaureate Degree =6
   Master's Degree = 7
   Doctoral Degree (PhD, MD, JD, etc.) = 8
   Other (please write in) = 9
   Specify: _____
   ____

5. What is your current Age.
   ____Yrs

6. What is your date of birth? ____ ____/____ ____/____ ____ ____ ____
   M M D D Y Y Y Y

7. Are you of Hispanic, Latino, or Spanish origin?	Yes = 1 No= 2	_____
8. What race best describes you?	Black or African American = 1 American Indian/ Alaskan Native = 2 Asian = 3 Native Hawaiian or Other Pacific Islander = 4 Caucasian/White = 5 Multi-ethnic/ "Mixed race" (Specify) = 6 Other (Specify) = 7 Refused = 8 8a. Specify _____	_____

Now we would like to ask you some questions about your HOUSEHOLD

9. Have you or a person living in your household already enrolled or previously participated in the ELM program?	Yes = 1 No = 2 Refused = 8 Don't Know = 9	_____

10. Not including you, how many other adults aged 18 or older live with you?	_____ **(If zero go to 13)**

11. In relation to you…	**Number over 18**
a. Spouse/partner	_____
b. Parent (including in law or step parent)	_____
c. Grandparent (including in law or step)	_____
d. Friend	_____
e. Son/daughter (including in law, adopted, step or foster)	_____
f. Brother/sister (including in law, adopted, step or foster)	_____
g. Grandchild	_____
h. Other relative	_____
i. Other (Specify) _____	_____

12 How many children under 18 live with you? **(If zero go to 15)** _____

12a. In relation to you…	**Number under 18**
a. Son/daughter (including in law, adopted, step or foster)	_____
b. Brother/sister (including in law, adopted, step or foster)	_____
c. Grandchild	_____
d. Other relative	_____
e. Other (Specify) _____	_____

13. How many working automobiles does your household currently own?	None = 0 1 = 1 2 = 2 3 or more = 3	_____
14. Do you still have reliable access to the internet on a computer or mobile device?	Yes = 1 **(ex)** No = 2 Don't Know = 9	_____

15. In the next two years do you anticipate…(Check all that apply)
☐ Relocating outside the city **(ex)**
☐ Having a major injury **(ex)**
☐ Having a major change in your schedule **(ex)**
☐ Experiencing any other situations that would interfere with your ability to participate in this program **(ex)**
☐ Having lack of reliable transportation to consistently attend group classes at the anticipated time **(ex)**
☐ None of the above
☐ Refused/Don't Know

Now I have some questions about your neighborhood.

16. Is there enough street lighting on the block around your home?	Yes = 1 No = 2 Sometimes = 3 Refuse = 8 Don't Know = 9	____
17. How often do you worry about your physical safety in your neighborhood?	Often = 1 Sometimes = 2 Never = 3 Refuse = 8 Don't Know = 9	____
18. During bad weather there is an area to be physically active in your neighborhood.	Yes = 1 No = 2 Refuse = 8 Don't Know = 9	____

Now I have some questions about your neighborhood. When we use the phrase *"around here"* or *"this neighborhood"* we are referring to your neighborhood.

Hand participant Hand Participant Flip Chart 1

How strongly do you agree or disagree with the following statements? Please tell me if you agree, are neutral or disagree with this statement…

	STRONGLY DISAGREE	DISAGREE	NEITHER AGREE NOR DISAGREE	AGREE	STRONGLY AGREE
19. The fresh fruits and vegetables in your neighborhood are of high quality	1	2	3	4	5
20. A large selection of fresh fruits and vegetables is available in your neighborhood.	1	2	3	4	5
21. A large selection of low-fat products is available in your neighborhood.	1	2	3	4	5

This section asks questions about your employment and income.

22. How would you describe your employment status?

Employed Full Time (≥ 35 hours a week) = 1
Employed Part Time (<35 hours a week) = 2
Not working for pay, but would like to work = 3
Choosing not to work for pay (includes stay-at-home caregiver)= 4
Retired = 5
Student and Employed = 6
Full-time student = 7
Disabled or too ill to work = 8
Refused = 88

_____

23. Do you receive disability benefits?

Yes = 1
No = 2
Refuse = 8
Don't Know = 9

_____

24. What is your total family income (before taxes) from all sources within your household in the last year?
(Mark the one that is your best guess. This information is important for describing the people in the study as a group and is, like all other questions, kept confidential).

Less than $5,000 = 1
$5,000 through $9,999 = 2
$10,000 through $14,999 = 3
$15,000 through $19,999 = 4
$20,000 through $29,999 = 5
$30,000 through $39,999 = 6
$40,000 through $49,999 = 7
$50,000 through $59,999 = 8
$60,000 through $69,999 = 9
$70,000 through $79,999 = 10
$80,000 through $89,999 = 11
$90,000 through $99,999 = 12
$100,000 through $149,999 = 13
$150,000 and greater = 14
Don't know = 99
Refuse = 88

_____

25. As best as you can, please estimate your combined yearly household income to the nearest $100. Again, this is income before taxes, including income from all working adults in your household. Do not include benefits such as public housing, Medicaid, and food stamps. *(write -9 if they don't want to /can't approximate)*		$_____
25a. How many people are supported by this income right now, including you? *Please count yourself and everyone supported by this income, even if they do not live in your household.*		_____
26. How hard is it for you to pay for the very basics like food, housing, medical care, and heating?	Very hard = 1 Somewhat hard = 2 Not hard at all = 3 Refuse = 8 Don't know = 9	_____

ACCESS to HEALTH CARE		
27. Do you have a primary care physician that you will be able to see for medical care during the trial?	Yes=1 **(ex)**No=2 Refused=8 Don't Know=9	_____
28. Do you currently have any health insurance or health coverage plans?	YES	No (STOP)

PART A: Do you have any of the follow medical coverage plans?	**If yes please answer part B.**	**28k: Do you use this to obtain medications?**
a. Insurance through a current or former employer or union (of this person or another family member)	No / Yes →	No / Yes
b. Private health insurance purchased directly from an insurance company (by this person or another family member) or Health Exchange.	No / Yes →	No / Yes
c. Medicare, for people 65 and older, or people with certain disabilities	No / Yes →	No / Yes
d. Medicaid, Medical Assistance, County Care, The Medical Card, CareLink, or any kind of government assistance plan	No / Yes →	No / Yes
e. TRICARE or other military health care	No / Yes →	No / Yes
f. VA (including those who have ever used or enrolled for VA health care)	No / Yes →	No / Yes
g. Indian Health Service	No / Yes →	No / Yes
h. Single Service Plan (e.g. dental, vision)	No / Yes →	No / Yes
i. Any other type of health insurance or health coverage plan (Specify): _____	No / Yes →	No / Yes

Stop assessment if participant has an exclusion on age <18 (Q5), enrollment in ELM (Q9), logistical barriers (Q14+Q15) for the trial, or lack of a PCP (Q27)

Medical History *Hand participant Flip Chart 2*				
"I am going to ask you if your doctor has ever told you that you had any of the following:"	**Yes**	**No**	**Don't Know**	**Refuse**
29. Has a doctor ever told you that you had a heart attack or, myocardial infarction? **(ex)**	**1** (Go to 29a)	**2** (Go to 30)	**9** (Go to 30)	**8** (Go to 30)
29a. How old were you when you had your 1st Heart attack or myocardial infarction?	**_____ yrs**			
30. Do you currently have a prescription for sublingual (under the tongue) nitroglycerin, tablets that you place under your tongue when you are having chest pain?	**1**	**2**	**9**	**8**
31. Has a doctor ever told you that you had high blood pressure, or hypertension?	**1**	**2**	**9**	**8**
32. Has a doctor ever told you that you had heart failure?	**1** (Go to 35)	**2** (Go to 36)	**9** (Go to 36)	**8** (Go to 36)
32a. How old were you when you were diagnosed with heart failure?	**_____ yrs**			
33. Has a doctor ever told you that you had cancer?	**1** (Go to 34)	**2** (Go to 35)	**9** (Go to 35)	**8** (Go to 35)
34. Are you currently being treated for cancer? **(ex)**	**1**	**2**	**9**	**8**
35. Has a doctor ever told you that you had a stroke? **(ex)**	**1** (Go to 36)	**2** (Go to 37)	**9** (Go to 37)	**8** (Go to 37)
36. Do you still have any remaining problems because of your stroke? **(ex)**	**1**	**2**	**9**	**8**
36a. How old were you when you had your 1st Stroke?	**_____ yrs**			
37. Has a doctor ever told you that you had kidney problems (renal insufficiency)? **(ex)**	**1** (Go to 38)	**2** (Go to 39)	**9** (Go to 39)	**8** (Go to 39)
38. Are you currently on dialysis?	**1**	**2**	**9**	**8**
39. Has a doctor ever told you that you have diabetes (Type 1 or 2) **(ex)**	**1**	**2**	**9**	**8**
40. Has a doctor ever told you that you had arthritis?	**1**	**2**	**9**	**8**

Medical History *Hand participant Flip Chart 2*

"I am going to ask you if your doctor has ever told you that you had any of the following:"	**Yes**	**No**	**Don't Know**	**Refuse**
41. Has a doctor ever told you that you had cirrhosis or liver disease (example: hepatitis B or C)? **(check with site physician)**	**1**	**2**	**9**	**8**
42. Has a doctor ever told you that you had depression?	**1**	**2**	**9**	**8**
43. Has a doctor ever told you that you had asthma?	**1** (Go to 44)	**2** (Go to 45)	**9** (Go to 45)	**8** (Go to 45)
44. Does it keep you from being physically active? **(ex)**	**1**	**2**	**9**	**8**
45. Has a doctor ever told you that you have COPD (Chronic Obstructive Pulmonary Disease)/ or emphysema? **(ex)**	**1**	**2**	**9**	**8**
46. Has a doctor ever told you that you have any other lung disease? **(Check with site physician)**	**1**	**2**	**9**	**8**
47. Has a doctor ever told you that you had sleep apnea? **(Check with site physician)**	**1**	**2**	**9**	**8**
48. Has a doctor ever told you that you had Neurological diseases (examples: Parkinson's, *Multiple sclerosis)*? **(Check with site physician)**	**1**	**2**	**9**	**8**
49. Do you currently have, or receive treatment for, schizophrenia, bipolar disorder, or any other mental health disorders involving hallucinations or disturbances in thinking? **(ex)**	**1**	**2**	**9**	**8**
50. Have you been hospitalized for a psychiatric condition in the past 6 months? **(ex)**	**1**	**2**	**9**	**8**
51. In the past 5 years have you been diagnosed with an eating disorder such as anorexia nervosa, binge eating, bulimia nervosa? **(ex)**	**1**	**2**	**9**	**8**
52. In the last 3 months have you taken any prescribed medications for weight loss? **(ex)**	**1**	**2**	**9**	**8**
53. Are you currently taking a supplement that claims to promote weight loss,that is not prescribed by your doctor? **(ex)**	**1**	**2**	**9**	**8**
54. Are you willing to abstain from taking any medications or supplements for weight loss during the trial? **(ex)**	**1**	**2**	**9**	**8**
55. Have you had bariatric surgery or bowel resection surgery, or do you plan to have either of these procedures in the next 2 years? **(ex)**	**1**	**2**	**9**	**8**
56. Have you ever been diagnosed with HIV or AIDS? **(ex)**	**1**	**2**	**9**	**8**

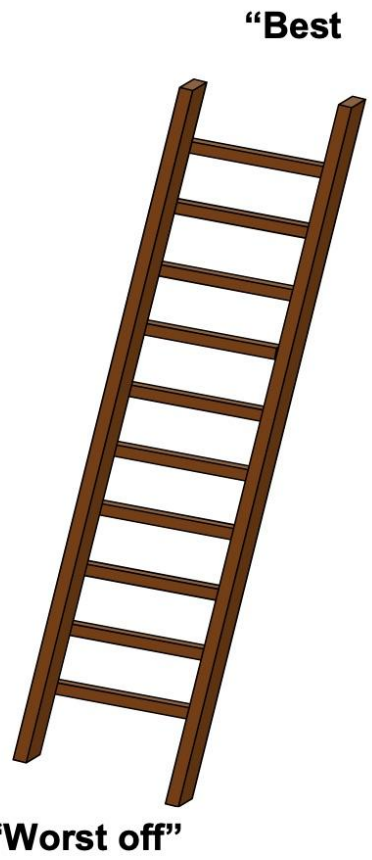
57. Do you have uncorrected hearing or vision problems that could make it difficult for you to exercise or interact with others in a group setting?	**1**	**2**	**9**	**8**
Medical History *Hand participant Flip Chart 2*				
"I am going to ask you if your doctor has ever told you that you had any of the following:"	**Yes**	**No**	**Don't Know**	**Refuse**
58. Has a doctor ever told you that you had any other chronic diseases? (**Check with site physician)**	**1** (Go to 58a)	**2** (Go to 59)	**9** (Go to 59)	**8** (Go to 59)
58a If Yes Specify other chronic diseases: _____				
59. Do you have any major food allergies or dietary preferences that significantly limit the foods you can eat?	**1** (Go to 59a)	**2** (Go to 61)	**9** (Go to 61)	**8** (Go to 61)
59a If Yes Specify food allergies/dietary preferences _____				
60. Are you currently pregnant, planning a pregnancy in the next 2 years, given birth in the last 6 months, or currently breastfeeding? **(ex)**	**1**	**2**	**9**	**8**
61. Are you able to walk a 2 block distance without assistance and without stopping? **(ex)**	**1**	**2**	**9**	**8**
62. Have you taken prednisone or any other steroids orally on more than 30 total days within the past year? This does NOT included steroids taken by inhaler or injection.	**1**	**2**	**9**	**8**
63. Compare the Chronic Conditions from the screener and those listed today. Are there any new conditions listed that were not mentioned at screening?	Yes=1 **(need site MD clearance)** No=2			
63b. Compare the food allergies from the screener and those listed today. Are there any new allergies listed that were not mentioned at screening?	Yes=1 **(need site MD clearance)** No=2			

Stop assessment if participant has an exclusion on medical History

64. Do you currently smoke cigarettes regularly (at least one cigarette a day)?	Yes = 1 No **(go to 69)** = 2 Refused **(go to 69)** = 8	____
a. How many cigarettes, on average, do you smoke per day now?		__ __
b. How many years have you smoked cigarettes?		__ __
c. In the past, did you smoke regularly? (at least one cigarette per day)	Yes = 1 No **(go to 65)** = 2 Refused = 8	____

d. What was the last year you smoked regularly? __ __ __ __

65. Think of this ladder as representing where people stand in our society. At the top of the ladder are the people who are the best off, those who have the most money, most education, and best jobs. At the bottom are the people who are the worst off, those who have the least money, least education, and worst jobs or no job. Please place an *X* on the rung that best represents where you think you stand on the ladder.



66. Do you feel you need to administer the Montreal Cognitive Assessment?	Yes (administer MOCA) = 1 No **(go to 68)** = 2 Refused = 8	_____
66a. MOCA Score	<-	_____

Thank you for agreeing to take part in this brief interview about alcohol, tobacco products and other drugs. I am going to ask you some questions about your experience of using these substances across your lifetime and in the past three months. These substances can be smoked, swallowed, snorted, inhaled, injected or taken in the form of pills (show drug card).

Some of the substances listed may be prescribed by a doctor (like amphetamines, sedatives, pain medications). For this interview, we will not record medications that are used as prescribed by your doctor. However, if you have taken such medications for reasons other than prescription, or taken them more frequently or at higher doses than prescribed, please let me know. While we are also interested in knowing about your use of various illicit drugs, please be assured that information on such use will be treated as strictly confidential.

NOTE: BEFORE ASKING QUESTIONS, GIVE ASSIST RESPONSE CARD TO PATIENT

67. Assist Question 1 In your life, which of the following substances have you ever used? (NON-MEDICAL USE O NLY)	**Yes**	**No**
a) Tobacco products (cigarettes, chewing tobacco, cigars, etc.)	0	3
b) Alcoholic beverages (beer, wine, spirits, etc.)	0	3
c) Cannabis (marijuana, pot, grass, hash, etc.)	0	3
d) Cocaine (coke, crack, etc.)	0	3
e) Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)	0	3
f) Inhalants (nitrous, glue, petrol, paint thinner, etc.)	0	3
g) Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)	0	3
h) Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)	0	3
i) Opioids (heroin, morphine, methadone, codeine, etc.)	0	3
j) Other Specify:_____	0	3

Probe if all answers are negative: " Not even when you were in school?"
If "No" to all items, go to last page (question 74)

If "Yes" to any of these items, ask Question 68:Assist Question 2 for each substance ever used.

68. Assist Question 2 ***Hand participant Flip Chart 3*** In the past three months, how often have you used the substances you mentioned (FIRST DRUG,SECOND DRUG, ETC)?	Never	Once or Twice	Monthly	Weekly	Daily or Almost Daily
a) Tobacco products (cigarettes, chewing tobacco, cigars, etc.)	0	2	3	4	6
b) Alcoholic beverages (beer, wine, spirits, etc.)	0	2	3	4	6
c) Cannabis (marijuana, pot, grass, hash, etc.)	0	2	3	4	6
d) Cocaine (coke, crack, etc.)	0	2	3	4	6
e) Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)	0	2	3	4	6
f) Inhalants (nitrous, glue, petrol, paint thinner, etc.)	0	2	3	4	6
g) Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)	0	2	3	4	6
h) Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)	0	2	3	4	6
i) Opioids (heroin, morphine, methadone, codeine, etc.)	0	2	3	4	6
j) Other specify:_____	0	2	3	4	6

If "Never" to all items in 68. Assist Question 2, skip to 72 Assist Question 6.

If any substances in 68 Assist Question 2 were used in the previous three months, continue to 69 Assist Question 3

69. Assist Question 3 During the past three months, how often have you had a strong desire or urge to use (FIRST DRUG, SECOND DRUG, ETC)?	Never	Once or Twice	Monthly	Weekly	Daily or Almost Daily
a) Tobacco products (cigarettes, chewing tobacco, cigars, etc.)	0	2	3	4	6
b) Alcoholic beverages (beer, wine, spirits, etc.)	0	2	3	4	6
c) Cannabis (marijuana, pot, grass, hash, etc.)	0	2	3	4	6
d) Cocaine (coke, crack, etc.)	0	2	3	4	6
e) Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)	0	2	3	4	6

f) Inhalants (nitrous, glue, petrol, paint thinner, etc.)	0	2	3	4	6
g) Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)	0	2	3	4	6
h) Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)	0	2	3	4	6
i) Opioids (heroin, morphine, methadone, codeine, etc.)	0	2	3	4	6
j) Other specify:_____	0	2	3	4	6

70. Assist Question 4 During the past three months, how often has your use of (FIRST DRUG, SECOND DRUG, ETC) led to health, social, legal or financial problems?	Never	Once or Twice	Monthly	Weekly	Daily or Almost Daily
a) Tobacco products (cigarettes, chewing tobacco, cigars, etc.)	0	4	5	6	7
b) Alcoholic beverages (beer, wine, spirits, etc.)	0	4	5	6	7
c) Cannabis (marijuana, pot, grass, hash, etc.)	0	4	5	6	7
d) Cocaine (coke, crack, etc.)	0	4	5	6	7
e) Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)	0	4	5	6	7
f) Inhalants (nitrous, glue, petrol, paint thinner, etc.)	0	4	5	6	7
g) Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)	0	4	5	6	7
h) Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)	0	4	5	6	7
i) Opioids (heroin, morphine, methadone, codeine, etc.)	0	4	5	6	7
j) Other specify:_____	0	4	5	6	7

71. Assist Question 5 During the past three months, how often have you failed to do what was normally expected of you because of your use of (FIRST DRUG, SECOND DRUG, ETC)?	Never	Once or Twice	Monthly	Weekly	Daily or Almost Daily
a) Tobacco products (cigarettes, chewing tobacco, cigars, etc.)	0	5	6	7	8
b) Alcoholic beverages (beer, wine, spirits, etc.)	0	5	6	7	8
c) Cannabis (marijuana, pot, grass, hash, etc.)	0	5	6	7	8
d) Cocaine (coke, crack, etc.)	0	5	6	7	8
e) Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)	0	5	6	7	8

f) Inhalants (nitrous, glue, petrol, paint thinner, etc.)	0	5	6	7	8
g) Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)	0	5	6	7	8
h) Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)	0	5	6	7	8
i) Opioids (heroin, morphine, methadone, codeine, etc.)	0	5	6	7	8
j) Other specify:_____	0	5	6	7	8

Ask Questions 72 (assist 6) & 73 (Assist 7) for all substances Questions substances ever used (i.e. those endorsed in Question 1)

72. Assist Question 6 ***Hand participant Flip Chart 4*** Has a friend or relative or anyone else ever expressed concern about your use of (FIRST DRUG, SECOND DRUG, ETC)?	No, Never	Yes, in the past 3 months	Yes, but not in the past 3 months
a) Tobacco products (cigarettes, chewing tobacco, cigars, etc.)	0	6	3
b) Alcoholic beverages (beer, wine, spirits, etc.)	0	6	3
c) Cannabis (marijuana, pot, grass, hash, etc.)	0	6	3
d) Cocaine (coke, crack, etc.)	0	6	3
e) Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)	0	6	3
f) Inhalants (nitrous, glue, petrol, paint thinner, etc.)	0	6	3
g) Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)	0	6	3
h) Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)	0	6	3
i) Opioids (heroin, morphine, methadone, codeine, etc.)	0	6	3
j) Other specify:_____	0	6	3

73. Assist Question 7 Have you ever tried and failed to control, cut down or stop using (FIRST DRUG, SECOND DRUG, ETC)?	No, Never	Yes, in the past 3 months	Yes, but not in the past 3 months
a) Tobacco products (cigarettes, chewing tobacco, cigars, etc.)	0	6	3
b) Alcoholic beverages (beer, wine, spirits, etc.)	0	6	3
c) Cannabis (marijuana, pot, grass, hash, etc.)	0	6	3
d) Cocaine (coke, crack, etc.)	0	6	3

e) 71f. Amphetamine type stimulants (speed, diet pills, ecstasy, etc.)	0	6	3
f) 72f. Inhalants (nitrous, glue, petrol, paint thinner, etc.)	0	6	3
g) 73f. Sedatives or Sleeping Pills (Valium, Serepax, Rohypnol, etc.)	0	6	3
h) 74f. Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.)	0	6	3
i) 75f. Opioids (heroin, morphine, methadone, codeine, etc.)	0	6	3
j) 76f. Other specify:_____	0	6	3
Move on?			
74. Have you ever used any drug by injection? (NON-MEDICAL USE ONLY)	No, Never	Yes, in the past 3 months	Yes, but not in the past 3
	0 (go to 80)	2	1 (go to 80)
a. How Often?			
☐ Once weekly or less or Fewer than 3 days in a row ☐ More than once per week or 3 or more days in a row			

PHQ8- ***Hand participant Flip Chart 5***

Over the last 2 weeks, how often have you been bothered by any of the following problems?

	Not at all	Several Days	More than half the days	Nearly every day
75. Little interest or pleasure in doing things?	0	1	2	3
76. Feeling down, depressed or hopeless?	0	1	2	3
77. Trouble falling or staying asleep, or sleeping too much?	0	1	2	3
78. Feeling tired or having little energy?	0	1	2	3
79. Poor appetite or overeating?	0	1	2	3
80. Feeling bad about yourself-or that you are a failure or have let yourself or your family down?	0	1	2	3
81. Trouble concentrating on things, such as reading the newspaper or watching television?	0	1	2	3

82. Moving or speaking so slowly that other people could have noticed? Or the opposite— being so fidgety or restless that you have been moving around a lot more than usual?	0	1	2	3
82a. How difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not Difficult at all =1 Somewhat difficult = 2 Very difficult= 3 Extremely difficult = 4			———

Stop assessment if participant has an exclusion on MOCA, Assist, or PHQ8

APPENDIX 2

ELM Set 2

Participant ID ____ ____ ____ ____ ____ ____ ____ ____

Date Form Completed ____ ____/____ ____/ 2 0 ____ ____
M M D D Y Y

Staff Name _____

Visit Baseline = V1, 6 Months = V2, 15 Months = V3, 24 Months = V4 ____

Think about what you usually ate last month. Please think about all the fruits and vegetables that you ate last month. Include those that were:
- raw and cooked,
- eaten as snacks and at meals,
- eaten at home and away from home (restaurants, friends, take-out)
- eaten alone and mixed with other foods

Report how many times per month, week, or day you ate each food, and if you ate it, how much you usually had.

1. Over the last month, how many times per month, week, or day did you drink **100% juice** such as orange, apple, grape, or grapefruit juice? **Do not count** fruit drinks like Kool-Aid, lemonade, Hi-C, cranberry juice drink, Tang, and Twister. Include juice you drank at all mealtimes and between meals.

☐ Never | ☐ 1- 3 times last month | ☐ 1- 2 times per week | ☐ 3-4 times per week | ☐ 5-6 times per week | ☐ 1 time per day | ☐ 2 times per day | ☐ 3 times per day | ☐ 4 times per day | ☐ 5+ times per day

1a. Each time you drank **100% juice**, how much did you usually drink?

☐ Less than 3/4 cup (less than 6 ounces) | ☐ 3/4 to 1 1/4 cup (6 to 10 ounces) | ☐ 1 1/4 to 2 cups (10 to 16 ounces) | ☐ More than 2 cups (more than 16 ounces)

2. Over the last month, how many times per month, week, or day did you eat **fruit**? **Do not count** juices. Include fruit you ate at all mealtimes and for snacks.

☐ Never	☐ 1- 3 times last month	☐ 1- 2 times per week	☐ 3-4 times per week	☐ 5-6 times per week	☐ 1 time per day	☐ 2 times per day	☐ 3 times per day	☐ 4 times per day	☐ 5+ times per day

2a. Each time you ate **fruit**, how much did you usually eat?

☐ Less than 1 medium fruit (less than 1/2 cup)	☐ 1 medium fruit (about 1/2 cup)	☐ 2 medium fruits (about 1 cup)	☐ More than 2 medium fruits (more than 1 cup)

3. Over the last month, how often did you eat **lettuce salad (with or without other vegetables)?**

☐ Never	☐ 1- 3 times last month	☐ 1- 2 times per week	☐ 3-4 times per week	☐ 5-6 times per week	☐ 1 time per day	☐ 2 times per day	☐ 3 times per day	☐ 4 times per day	☐ 5+ Times per day

3a. Each time you ate lettuce salad, how much did you usually eat?

☐ About 1/2 cup	☐ About 1 cup	☐ About 2 cups	☐ More than 2 cups

4. Over the last month, how often did you eat French fries or fried potatoes?

☐ Never	☐ 1- 3 times last month	☐ 1- 2 times per week	☐ 3-4 times per week	☐ 5-6 times per week	☐ 1 time per day	☐ 2 times per day	☐ 3 times per day	☐ 4 times per day	☐ 5+ times per day

4a. Each time you ate French fries or fried potatoes, how much did you usually eat?

☐ Small order or less (about 1 cup or less)	☐ Medium order (about 1½ cup or less)	☐ Large order (about 2 cups)	☐ Super-size order or more (about 3 cups or more)

5. Over the last month, how often did you eat **other white potatoes**? Count **baked, boiled,** and **mashed potatoes, potato salad,** and **white potatoes** that were not fried.

☐ Never	☐ 1- 3 times last month	☐ 1- 2 times per week	☐ 3-4 times per week	☐ 5-6 times per week	☐ 1 time per day	☐ 2 times per day	☐ 3 times per day	☐ 4 times per day	☐ 5+ times per day

5a. Each time you ate these potatoes, how much did you usually eat?

☐ 1 small potato or less (about 1/2 cup)	☐ 1 medium potato (1/2 to 1 cup)	☐ 1 large potato (1 to 1 1/2 cups)	☐ 2 medium potatoes or more (1 1/2 cups or more)

6. Over the last month, how often did you eat **cooked dried beans**? Count **baked beans, bean soup, refried beans, pork and beans and other bean dishes**.

☐ Never	☐ 1- 3 times last month	☐ 1- 2 times per week	☐ 3-4 times per week	☐ 5-6 times per week	☐ 1 time per day	☐ 2 times per day	☐ 3 times per day	☐ 4 times per day	☐ 5+ times per day

6a. Each time you ate **these beans**, how much did you usually eat?

☐ Less than 1/2 cup	☐ 1/2 to 1 cup	☐ 1 to 1½ cups	☐ 1½ cups or more

7. Over the last month, how often did you eat **other vegetables**?

DO NOT COUNT: Lettuce salads
White potatoes
Cooked dried beans
Vegetables in mixtures, such as in sandwiches, omelets, casseroles, Mexican dishes, stews, stir-fry, soups, etc.
Rice

COUNT: All other vegetables-raw, cooked, canned, and frozen

☐ Never	☐ 1- 3 times last month	☐ 1- 2 times per week	☐ 3-4 times per week	☐ 5-6 times per week	☐ 1 time per day	☐ 2 times per day	☐ 3 times per day	☐ 4 times per day	☐ 5+ times per day

7a. Each of these times that you ate **other vegetables**, how much did you usually eat?

☐ Less than 1/2 cup	☐ 1/2 to 1 cup	☐ 1 to 2 cups	☐ More than 2 cups

8. Over the last month, how often did you eat **tomato sauce**? Include tomato sauce on pasta or macaroni, rice, pizza and other dishes.

☐ Never	☐ 1- 3 times last month	☐ 1- 2 times per week	☐ 3-4 times per week	☐ 5-6 times per week	☐ 1 time per day	☐ 2 times per day	☐ 3 times per day	☐ 4 times per day	☐ 5+ times per day

8a. Each time you ate **tomato sauce**, how much did you usually eat?

☐ Less than 1/4 cup ☐ 1/2 cup ☐ 1 cup ☐ More than 1 cup

9. Over the last month, how often did you eat **vegetable soups**? Include tomato soup, gazpacho, beef with vegetable soup, minestrone soup, and other soups made with vegetables.

☐ Never	☐ 1- 3 times last month	☐ 1- 2 times per week	☐ 3-4 times per week	☐ 5-6 times per week	☐ 1 time per day	☐ 2 times per day	☐ 3 times per day	☐ 4 times per day	☐ 5+ times per day

9a. Each time you ate vegetable soup, how much did you usually eat?

☐ Less than 1 cup ☐ 1 to 2 cups ☐ 2 to 3 cups ☐ More than 3 cups

10. Over the last month, how often did you eat **mixtures that included vegetables**? Count such foods as sandwiches, casseroles, stews, stir-fry, omelets, and tacos.

☐ Never	☐ 1- 3 times last month	☐ 1- 2 times per week	☐ 3-4 times per week	☐ 5-6 times per week	☐ 1 time per day	☐ 2 times per day	☐ 3 times per day	☐ 4 times per day	☐ 5+ times per day

11. During the past 30 days how often did you drink regular soda or pop that contains sugar? Do not include diet soda or pop. You can answer times per day, week, or month: for example, twice a day, once a week, and so forth. _____ ☐ Day ☐ Week ☐ Month

12. During the past 30 days, how often did you drink sugar-sweetened fruit drinks (such as Kool-Aid and lemonade), sweet tea, and sports or energy drinks (such as Gatorade and Red Bull)? Do not include 100% fruit juice, diet drinks, or artificially sweetened drinks. You can answer times per day, week, or month: for example, twice a day, once a week, and so forth _____ ☐ Day ☐ Week ☐ Month

13. Which of these statements best describes the food eaten in your household in the last 12 months:

☐Enough of the kinds of food we want to eat

☐Enough but not always the kinds of food we want

☐Sometimes not enough to eat

☐Often not enough to eat

☐Don't Know / Refused

14.	Often true	Sometimes true	Never true	Don't Know or Refuse
a. "We worried whether our food would run out before we got money to buy more." Was that often true, sometimes true, or never true for your household in the last 12 months?	☐	☐	☐	☐
b. "The food that we bought just didn't last, and we didn't have money to get more." Was that often, sometimes, or never true for your household in the last 12 months?	☐	☐	☐	☐
c. "We couldn't afford to eat balanced meals." Was that often, sometimes, or never true for your household in the last 12 months?	☐	☐	☐	☐

	Yes	No	Don't Know / Refused
15. In the last 12 months, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?	☐	☐	☐
16. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?	☐	☐	☐
17. In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?	☐	☐	☐
18. In the last 12 months, did you lose weight because there wasn't enough money for food?	☐	☐	☐
19. In the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food?	☐	☐	☐

19a. How often did this happen-almost every month, some months but not every month, or in only 1 or 2 months?

☐Almost every month

☐Some months but not every month

☐Only 1 or 2 months

☐Don't Know / Refused

20. In general, would you say your health is:	☐ Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Poor
21. Compared to one year ago, how would you rate your health in general now?	☐ Much better now than one year ago ☐ Somewhat better now than one year ago ☐ About the same as one year ago ☐ Somewhat worse than one year ago ☐ Poor

22. The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, limited a lot	**Yes, limited a little**	**No not limited at all**
a. Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	☐	☐	☐
b. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	☐	☐	☐
c. Lifting or carrying groceries	☐	☐	☐
d. Climbing several flights of stairs	☐	☐	☐
e. Climbing one flight of stairs	☐	☐	☐
f. Bending, kneeling, or stooping	☐	☐	☐
g. Walking more than a mile	☐	☐	☐
h. Walking several blocks	☐	☐	☐
i. Walking one block	☐	☐	☐
j. Bathing or dressing yourself	☐	☐	☐

23. During the **past 4 weeks**, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of your **physical health**?

	Yes	No
a. Cut down on the amount of time you spent on work or other activities	☐	☐
b. Accomplished less than you would like	☐	☐
c. Were limited in the kind of work or other activities	☐	☐
d. Had difficulty performing the work or other activities (for example, it took extra effort)	☐	☐

24. During the **past 4 weeks**, how much of the time have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

	Yes	No
a. Cut down on the amount of time you spent on work or other activities	☐	☐
b. Accomplished less than you would like	☐	☐
c. Didn't do work or other activities as carefully as usual	☐	☐

25. During the past 4 weeks, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

☐ Not at all
☐ Slightly
☐ Moderately
☐ Quite a bit
☐ Extremely

26. How much bodily pain have you had during the past 4 weeks?

☐ None
☐ Very Mild
☐ Mild
☐ Moderate
☐ Severe
☐ Very Severe

27. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

- ☐ Not at all
- ☐ A little bit
- ☐ Moderately
- ☐ Quite a bit
- ☐ Extremely

28. How much of the time during the past 4 weeks...

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Did you feel full of pep?	☐	☐	☐	☐	☐
b. Have you been very nervous?	☐	☐	☐	☐	☐
c. Have you felt so down in the dumps that nothing could cheer you up?	☐	☐	☐	☐	☐
d. Have you felt calm and peaceful?	☐	☐	☐	☐	☐
e. Did you have a lot of energy?	☐	☐	☐	☐	☐
f. Have you felt downhearted and blue?	☐	☐	☐	☐	☐
g. Did you feel worn out?	☐	☐	☐	☐	☐
h. Have you been a happy person?	☐	☐	☐	☐	☐
i. Did you feel tired?	☐	☐	☐	☐	☐

29. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

- ☐ All of the time
- ☐ Most of the time
- ☐ Some of the time
- ☐ A little of the time
- ☐ None of the time

30. How TRUE or FALSE is each of the following statements for you?

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
a. I seem to get sick a little easier than other people	☐	☐	☐	☐	☐
b. I am as healthy as anybody I know	☐	☐	☐	☐	☐
c. I expect my health to get worse	☐	☐	☐	☐	☐
d. My health is excellent	☐	☐	☐	☐	☐

APPENDIX 3

ELM Set 3

Participant ID ____ ____ ____ ____ ____ ____ ____ ____

Date of Form ____ ____/____ ____/ 2 0 ____ ____
M M D D Y Y

Staff Name ____ ____ ____

Baseline = V1
6 Months = V2
15 Months = V3
24 Months = V4 ____

Please rate each of the following statements using the scale provided. Select the answer that best describes your own opinion of what is generally true for you.

	Never or very rarely true	Rarely True	Sometimes True	Often True	Very Often or always true
1. When I'm walking, I deliberately notice the sensations of my body moving.	☐	☐	☐	☐	☐
2. I'm good at finding words to describe my feelings.	☐	☐	☐	☐	☐
3. I criticize myself for having irrational or inappropriate emotions.	☐	☐	☐	☐	☐
4. I perceive my feelings and emotions without having to react to them.	☐	☐	☐	☐	☐
5. When I do things, my mind wanders off and I'm easily distracted.	☐	☐	☐	☐	☐
6. When I take a shower or bath, I stay alert to the sensations of water on my body.	☐	☐	☐	☐	☐
7. I can easily put my beliefs, opinions, and expectations into words.	☐	☐	☐	☐	☐
8. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.	☐	☐	☐	☐	☐
9. I watch my feelings without getting lost in them.	☐	☐	☐	☐	☐
10. I tell myself I shouldn't be feeling the way I'm feeling.	☐	☐	☐	☐	☐
11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.	☐	☐	☐	☐	☐

Please rate each of the following statements using the scale provided. Select the answer that best describes your own opinion of what is generally true for you.

	Never or Very Rarely true	Rarely True	Sometimes True	Often True	Very Often or Always true
12. It's hard for me to find the words to describe what I'm thinking.	☐	☐	☐	☐	☐
13. I am easily distracted.	☐	☐	☐	☐	☐
14. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.	☐	☐	☐	☐	☐
15. I pay attention to sensations, such as the wind in my hair or sun on my face.	☐	☐	☐	☐	☐
16. I have trouble thinking of the right words to express how I feel about things	☐	☐	☐	☐	☐
17. I make judgements about whether my thoughts are good or bad.	☐	☐	☐	☐	☐
18. I find it difficult to stay focused on what's happening in the present.	☐	☐	☐	☐	☐
19. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.	☐	☐	☐	☐	☐
20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.	☐	☐	☐	☐	☐
21. In difficult situations, I can pause without immediately reacting.	☐	☐	☐	☐	☐
22. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.	☐	☐	☐	☐	☐
23. It seems I am "running on automatic" without much awareness of what I'm doing.	☐	☐	☐	☐	☐
24. When I have distressing thoughts or images, I feel calm soon after.	☐	☐	☐	☐	☐
25. I tell myself that I shouldn't be thinking the way that I'm thinking.	☐	☐	☐	☐	☐
26. I notice the smells and aromas of things.	☐	☐	☐	☐	☐
27. Even when I'm feeling terribly upset, I can find a way to put it into words.	☐	☐	☐	☐	☐
28. I rush through activities without being attentive to them.	☐	☐	☐	☐	☐

Please rate each of the following statements using the scale provided. Select the answer that best describes your own opinion of what is generally true for you.

	Never or Very Rarely true	Rarely True	Sometimes True	Often True	Very Often or Always true
29. When I have distressing thoughts or images I am able just to notice them without reacting.	☐	☐	☐	☐	☐
30. I think some of my emotions are bad or inappropriate and I shouldn't feel them.	☐	☐	☐	☐	☐
31. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.	☐	☐	☐	☐	☐
32. My natural tendency is to put my expressions into words.	☐	☐	☐	☐	☐
33. When I have distressing thoughts or images, I just notice them and let them go.	☐	☐	☐	☐	☐
34. I do jobs or tasks automatically without being aware of what I'm doing.	☐	☐	☐	☐	☐
35. When I have distressing thoughts or images, I judge myself as good or bad, depending on what the thought/ image is about.	☐	☐	☐	☐	☐
36. I pay attention to how my emotions affect my thoughts and behavior.	☐	☐	☐	☐	☐
37. I can usually describe how I feel at the moment in considerable detail.	☐	☐	☐	☐	☐
38. I find myself doing things without paying attention.	☐	☐	☐	☐	☐
39. I disapprove of myself when I have irrational ideas.	☐	☐	☐	☐	☐

Engaging in physical activity on most days is something...

□	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
40. I do automatically	☐	☐	☐	☐	☐
41. I do without having to consciously remember	☐	☐	☐	☐	☐
42. I do without thinking	☐	☐	☐	☐	☐
43. I start doing before I realize I'm doing it	☐	☐	☐	☐	☐
44. Belongs to my (daily, weekly, monthly) routine	☐	☐	☐	☐	☐

Eating ½ plate of vegetables for lunch and dinner is something...

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
45. I do automatically	☐	☐	☐	☐	☐
46. I do without having to consciously remember	☐	☐	☐	☐	☐
47. I do without thinking	☐	☐	☐	☐	☐
48. I start doing before I realize I'm doing it	☐	☐	☐	☐	☐
49. Belongs to my (daily, weekly, monthly) routine	☐	☐	☐	☐	☐

Putting a pause between a stressor and my reaction to it is something...

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
50. I do automatically	☐	☐	☐	☐	☐
51. I do without having to consciously remember	☐	☐	☐	☐	☐
52. I do without thinking	☐	☐	☐	☐	☐
53. I start doing before I realize I'm doing it	☐	☐	☐	☐	☐
54. Belongs to my (daily, weekly, monthly) routine	☐	☐	☐	☐	☐

Using all my senses to notice sounds, smells, tastes, colors, textures, thoughts, and bodily sensations is something…

	Strongly Disagree	Disagree	Neither Agree or Disagree	Agree	Strongly Agree
55. I do automatically	☐	☐	☐	☐	☐
56. I do without having to consciously remember	☐	☐	☐	☐	☐
57. I do without thinking	☐	☐	☐	☐	☐
58. I start doing before I realize I'm doing it	☐	☐	☐	☐	☐
59. Belongs to my (daily, weekly, monthly) routine	☐	☐	☐	☐	☐

All participants in the ELM trial will be randomly assigned (by chance) to one of two lifestyle programs to reverse Metabolic Syndrome. One is a Group-Based Program and the other is a Self-Directed Program. Participants in both programs will receive:

- Free Fitbit wearable
- Access to a website with educational material
- Progress reports with lab results sent to you and your physician

Participants in the Self-Directed Program also receive evidence-based tip sheets from nationally recognized organizations. Tip sheets will be sent every month via mail or email. Participants can follow the recommendations on the tip sheets to help reverse metabolic syndrome.

Participants in the Group-Based program will attend 36 group sessions focused on physical activity, nutrition education, and group discussion. Group sessions each last 90 minutes. Participants can follow the recommendations provided during the group sessions to help reverse metabolic syndrome.

60. Even though you will be randomly assigned to only one of these two programs (based purely on chance), we want to know whether you have a preference for one program or another. Which of the following statements do you agree with:
    - ☐ I prefer to be in the Group-Based Program
    - ☐ I prefer to be in the Self-Directed Program
    - ☐ I don't have a preference between the two programs

61. Indicate how strongly you prefer one program or another. Putting the arrow middle of the line means you have no preference. Moving the arrow to either end of the line means you have a strong preference for the program indicated.

    Self Directed ----------Group Based

62. How many people are there in your life who are actively involved in enhancing their health and lifestyle?

    _____

63. How often do you interact with people who support you with your health?
    - ☐ Never
    - ☐ A little
    - ☐ Sometimes
    - ☐ Often
    - ☐ Very often

Below is a list of things people might do or say to someone who is trying to improve their eating habits. We are interested in high fat and high salt (or high sodium) foods. If you are not trying to make any of these dietary changes, then some of the questions may not apply to you, but please read and give an answer to every question.
Please rate each question twice. Under family, rate how often anyone living in your household has said or done what is described during the last three months. Under friends, rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.

None	Rarely	A few times	Often	Very often	Does not apply
1	2	3	4	5	8

During the past three months, my family (or members of my household) or friends:

	Family	Friends
64. Encouraged me not to eat "unhealthy foods" (cake, salted chips) when I'm tempted to do so	a._____	b._____
65. Discussed my eating habit changes with me (asked me how I'm doing with my eating changes)	a._____	b._____
66. Reminded me not to eat unhealthy food	a._____	b._____
67. Complimented me on changing my eating habits ("Keep it up", "We are proud of you ")	a._____	b._____
68. Commented if I went back to my old eating habits	a._____	b._____
69. Ate unhealthy foods in front of me	a._____	b._____
70. Refused to eat the same foods I eat	a._____	b._____
71. Brought home foods I'm trying not to eat	a._____	b._____
72. Got angry when I encouraged them to eat low salt, low fat foods	a._____	b._____
73. Offered me food I'm trying not to eat	a._____	b._____

Below is a list of things people might do or say to someone who is trying to exercise regularly. If you are not trying to exercise, then some of the questions may not apply to you, but please read and give an answer to every question.

Please rate each question twice. Under family, rate how often anyone living in your household has said or done what is described during the last three months. Under friends, rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.

None	Rarely	A few times	Often	Very often	Does not apply
1	2	3	4	5	8

During the past three months, my family (or members of my household) or friends:

	Family	Friends
74. Exercised with me	a._____	b._____
75. Offered to exercise with me	a._____	b._____
76. Gave me helpful reminders to exercise ("Are you going to exercise tonight?")	a._____	b._____
77. Gave me encouragement to stick with my exercise program	a._____	b._____
78. Changed their schedule so we could exercise together	a._____	b._____
79. Discussed exercise with me	a._____	b._____
80. Complained about the time I spend exercising	a._____	b._____
81. Criticized me or made fun of me for exercising	a._____	b._____
82. Gave me rewards for exercising (bought me something or gave me something I like)	a._____	b._____
83. Planned for exercise on recreational outings	a._____	b._____
84. Helped plan events around my exercise	a._____	b._____
85. Asked me for ideas on how they can get more exercise	a._____	b._____
86. Talked about how much they like to exercise	a._____	b._____

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer each question fairly quickly. That is, don't try to count up the number of times you felt a particular way, but rather indicate the alternative that seems like a reasonable estimate. For each question choose from the following alternatives: Never, Almost Never, Sometimes, Fairly often, Very often.

In the last month...

	Never	Almost Never	Sometimes	Fairly Often	Very Often
87. How often have you been upset because of something that happened unexpectedly?	☐	☐	☐	☐	☐
88. How often have you felt that you were unable to control the important things in your life?	☐	☐	☐	☐	☐
89. How often have you felt nervous and stressed?	☐	☐	☐	☐	☐
90. How often have you dealt successfully with irritating life hassles?	☐	☐	☐	☐	☐
91. How often have you felt that you were effectively coping with important changes that were occurring in your life?	☐	☐	☐	☐	☐
92. How often have you felt confident about your ability to handle your personal problems?	☐	☐	☐	☐	☐
93. How often have you felt that things were going your way?	☐	☐	☐	☐	☐
94. How often have you found that you could not cope with all the things that you had to do?	☐	☐	☐	☐	☐
95. How often have you been able to control irritations in your life?	☐	☐	☐	☐	☐
96. How often have you felt that you were on top of things?	☐	☐	☐	☐	☐
97. How often have you been angered because of things that happened that were outside of your control?	☐	☐	☐	☐	☐
98. How often have you found yourself thinking about things that you have to accomplish?	☐	☐	☐	☐	☐
99. How often have you been able to control the way you spend your time?	☐	☐	☐	☐	☐
100. How often have you felt difficulties were piling up so high that you could not overcome them?	☐	☐	☐	☐	☐

Below are statements about your eating. Think about each one, then choose the best response for you.

	Always	Often	Sometimes	Rarely	Never
101. I am relaxed about eating	☐	☐	☐	☐	☐
102. I am comfortable about eating enough	☐	☐	☐	☐	☐
103. I have regular meals	☐	☐	☐	☐	☐
104. I feel it is okay to eat food that I like	☐	☐	☐	☐	☐
105. I experiment with new food and learn to like it	☐	☐	☐	☐	☐
106. If the situation demands, I can "make do" by eating food I don't much care for	☐	☐	☐	☐	☐
107. I eat a wide variety of foods	☐	☐	☐	☐	☐
108. I am comfortable with my enjoyment of food and eating	☐	☐	☐	☐	☐

Below are statements about your eating. Think about each one, then choose the best response for you.

	Always	Often	Sometimes	Rarely	Never
109. I trust myself to eat enough for me	☐	☐	☐	☐	☐
110. I eat as much as I am hungry for	☐	☐	☐	☐	☐
111. I tune in to food and pay attention to eating	☐	☐	☐	☐	☐
112. I make time to eat	☐	☐	☐	☐	☐
113. I eat until I feel satisfied	☐	☐	☐	☐	☐
114. I enjoy food and eating	☐	☐	☐	☐	☐
115. I consider what is good for me when I eat	☐	☐	☐	☐	☐
116. I plan for feeding myself	☐	☐	☐	☐	☐